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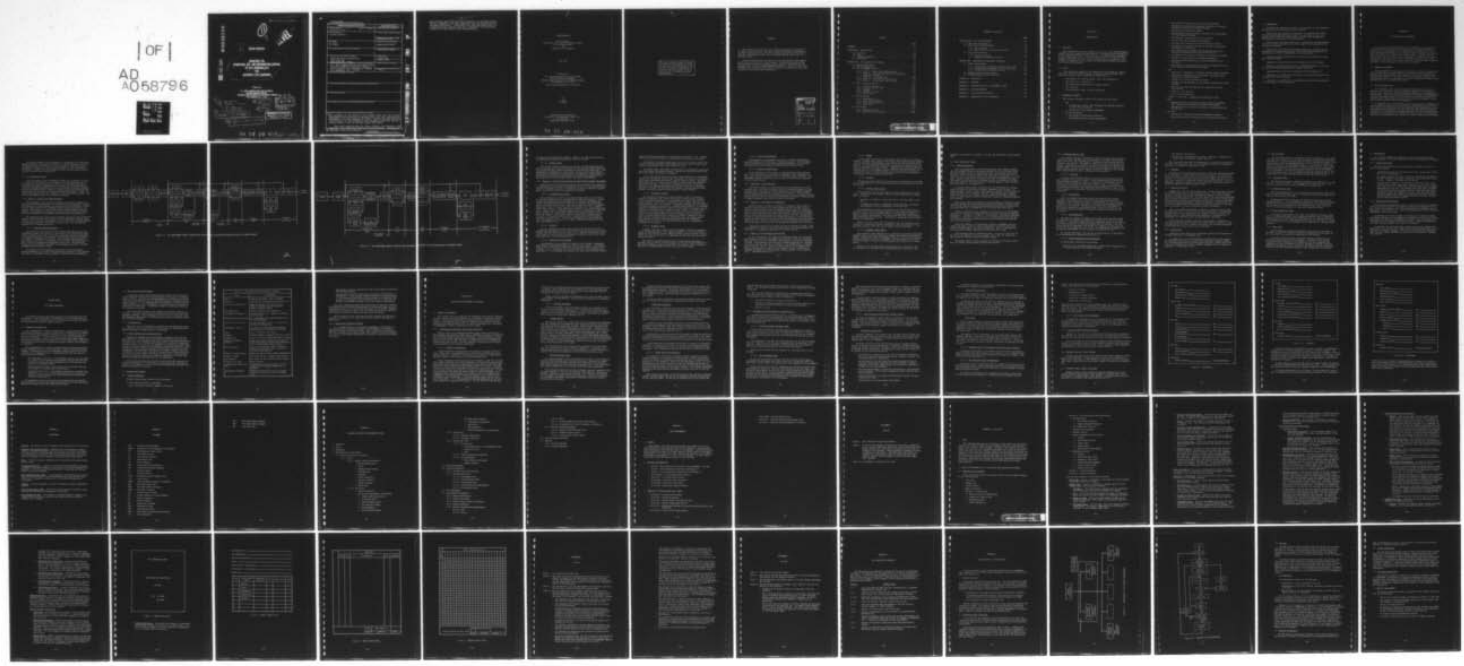

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GUIDELINES FOR ACQUISITION, USE, AND CONFIGURATION CONTROL OF TEST PROGRAM SETS FOR AUTOMATIC TEST EQUIPMENT,

Prepared for

U.S. ARMY COMMUNICATIONS AND ELECTRONICS
MATERIEL READINESS COMMAND/
COMMUNICATIONS RESEARCH AND DEVELOPMENT COMMAND
FORT MONMOUTH, N.J. 17703

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This document is the result of an in-depth study into the current requirements and practices in acquisition, use, and configuration management of a Test Program Set (TPS). The TPS includes application software for the Automatic Test Equipment (ATE) and the Interface Devise (ID) to the Unit Under Test (UUT).

Data were compiled from all three services and industry, with emphasis on the total TPS life-cycle considerations. Procedures →

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CERCOM/CORADCOM

Guidelines for Acquisition, Use, and Configuration Control of Test Program Sets for Automatic Test Equipment

July 1978

Prepared for

U.S. Army Communications and Electronics
Materiel Readiness Command/
Communications Research and Development Command
Fort Monmouth, N.J. 17703

under Contract DAEA18-72-A-0005-0011

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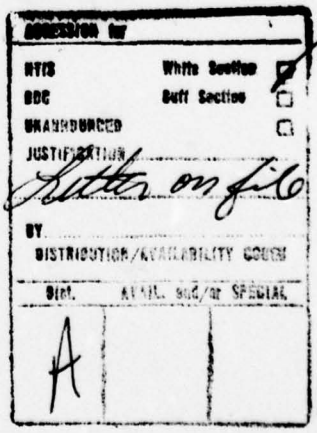
The views, opinions, and/or findings contained in this document are those of the authors and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

FOREWORD

This document is the result of an in-depth study into the current requirements and practices in acquisition, use, and configuration management of a Test Program Set (TPS). The TPS includes application software for the Automatic Test Equipment (ATE) and the Interface Device (ID) to the Unit Under Test (UUT).

Data were compiled from all three services and industry, with emphasis on the total TPS life-cycle considerations. Procedures and policies that have been most effective in ensuring quality TPS were identified and were compared with the current CERCOM/CORADCOM guidelines. Guidelines were then developed that integrated proven quality policies, procedures, and practices suitable for the current Army organization.



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CONTENTS (continued)

CHAPTER ONE

INTRODUCTION

1.1 OBJECTIVE

These guidelines have been prepared to assist U.S. Army CERCOM/CORADCOM agencies and their supporting organizations in establishing and implementing policies and procedures for acquisition, use, and configuration management of Test Program Sets (TPSs). The information provided is directed toward managers responsible for specification, acquisition, and acceptance of TPS in both the readiness and the research and development elements responsible for TPS use and maintenance.

1.2 SCOPE

These guidelines establish requirements for Test Program Set acquisition, use, and configuration control for Automatic Test Equipment (ATE). Special attention in these guidelines has been given to:

- Requirements for TPS development, test, and documentation
- TPS life-cycle considerations
- TPS configuration management and change control
- TPS acceptance
- TPS maintenance, usage, and data collection

1.3 REFERENCE DOCUMENTS

The following documents relate to the subject of this study:

- DoD
  - DoD 5000.29, 26 April 1976, Management of Computer Resources in Major Defense Systems
  - DoD/AR-70-37, Configuration Management
- Military Standards
  - MIL-STD-490, Specification Practices
  - MIL-Q-9858A, Quality Program Requirements

- •• MIL-S-52779A, Software Quality Assurance Requirement
- •• MIL-STD-483, Configuration Management Practices for Systems, Equipment, Munitions and Computer Programs
- •• MIL-STD-480, Configuration Control
- •• MIL-STD-1521A, Technical Reviews and Audits for System Equipment and Computer Programs
- •• MIL-STD-482A, Configuration Status Accounting
- •• MIL-STD-1519, TRD Preparation Requirements
- •• MIL-STD-1000A, Engineering and Associated List Drawing
- •• MIL-STD-785A, Reliability Program for Systems and Equipment Development and Production
- •• MIL-T-28800A, Test Equipment for Use With Electrical and Electronic Equipment, General Specifications for
- •• MIL-HDBK-217B, Reliability Prediction of Electronic Equipment
- •• MIL-STD-470, Maintainability Program Requirements
- •• MIL-STD-471A, Maintainability Verification/Demonstration/Evaluation
- •• MIL-T-21200L, General Specification for Test Equipment for Use With Electronic and Electrical Equipment

• Army

- •• ECOMR 702-13, Management of Computer Software Quality Assurance
- •• ECOM PA76-9, Preparation of UUT Automatic Performance Test Programs for Avionics Equipment
- •• DESCOMR 702-1, Quality Assurance Program
- •• USASAMSC STD 490, Standard for ATE English Language Test Design Document
- •• TOAD PCC116-111076, ATS Application Program Verification Requirements
- •• ECOMR 10-1, PAD Charters
- •• AR 702-4, Procurement QA

• Industry -- RCA Corp. - Program Design Handbook for ATE

• Navy

- •• NAVMATINST 3960.9, Acquisition Planning Guide for Automatic Test, Monitoring and Diagnostic Systems and Equipment
- •• NAVAIRSYSCOM AR-9A, General Requirements for Operational Test Program Sets

• Air Force

- •• ESD TR-75-91, Software Acquisition Management Guidebook
- •• ESD TR-76-365, An Air Force Guide to Contracting for Software

1.4 ORGANIZATION

Following this introductory chapter, the remainder of this document is organized into three chapters and six appendixes.

Chapter Two, TPS Acquisition Guidelines, is intended to be used by Government procurement personnel as part of a statement of work. All phases of TPS acquisition are described in detail, from development of requirements to acceptance of TPS deliverables.

Chapter Three, TPS Usage Guidelines, is designed for the ATE managers and discusses TPS maintenance, operational aspects, and organization and training requirements.

Chapter Four, Configuration Management Guidelines, discusses the requirements for configuration control of TPSs and provides appropriate requirements for reviews, documentation, and change control.

Appendix A provides definitions for terms that are peculiar to automatic testing and TPSs.

Appendix B lists and defines the acronyms used in this document.

Appendix C provides an outline for a suggested statement of work for use by the technical planning and procurement personnel.

Appendix D defines the data requirements for TPS acquisition.

Appendix E is a checklist of the steps to be taken and the data to be provided to the TPS contractors.

Appendix F is a definition of recommended organizational responsibilities for support of TPS maintenance.

CHAPTER TWO

TPS ACQUISITION GUIDELINES

This chapter provides guidelines for the Government to use during the acquisition of TPS and contains all phases of the contracted effort, including design, development, test, documentation, and delivery of TPSs. These guidelines shall apply to all classes of UUTs including Line Replaceable Units (LRUs) and Printed Circuit Boards (PCBs). Special cases for TPSs developed for all digital UUTs using digital simulation and automatic test program generation aids are also addressed in this section. Where variations in UUT types (i.e., analog, digital, or hybrid) require separate treatment, those requirements will be clearly addressed.

2.1 GENERAL REQUIREMENTS

The TPS consists of a hardware Interface Device (ID) that connects the UUT to the ATE and a computer program that controls the ATE functions by automatically selecting and routing stimuli to the UUT and automatically measuring UUT response. The IDs may be shared by multiple devices. The software portions of the TPSs shall be given an identification number, which corresponds to the associated UUT number.

2.2 TPS DEVELOPMENT PLAN

The contractor shall generate a TPS Development Plan (DP) to be approved by the Government. The plan addresses schedules of activities, audits, and reviews; configuration management practices; and documentation requirements. Interface device design and TPS reliability, maintainability, and test requirements shall also be included in this plan, including UUT and ATE station requirements and any other facility and equipment requirements for TPS quality control and acceptance.

An important part of the TPS DP will be the provision for compatibility with the ATE and procedures to ensure proper configuration control of the TPS, handling of change proposals, and maintenance and updating of the configuration control baselines. The plan shall be kept current throughout the duration of the contract and shall guide the contractor and Government personnel in the scheduling of reviews and audits, as well as defining the controls to be employed by the contractor to assure contractual performance.

To provide guidance to the contractors, a discussion of the TPS development activities is presented in Section 2.3, which identifies issues to be addressed by contractors in their plan. However, contractors are encouraged to develop a plan that is most efficient in their own working environment. Chapter Four and Appendix D contain further details regarding the content of the contractor DP.

2.3 TPS DEVELOPMENT PHASES

The major phases in the development of TPSs are illustrated in Figure 2-1. Most of the activities are performed by the TPS contractor who is responsible for developing the TPS. The role of Government personnel is to review the analysis, implementation, and tests and to perform evaluations for determining compliance with the procurement guidelines and satisfaction of contract intent. Figure 2-1 applies when only limited ATE data are available to the potential contractors during procurement. Figure 2-2 applies when complete data are available with the procurement package. The initial development phases are shortened accordingly.

2.3.1 Phase I -- Source Data Familiarization

TPS development starts when the contractor test design engineers are familiarized with available data on the UUTs and the proposed ATE. For the sole purpose of TPS development, the contractor will be entitled to receive or have timely access to all Government-owned UUT data applicable to his project. From analysis of these data, the test designer shall develop an outline of the approach for testing the UUT and shall identify any incompatibilities between UUT performance requirements and ATE capabilities.

The contractor shall prepare the Conceptual Test Design and Instruction Document (TDID) package, which includes a test requirements analysis, preliminary test strategy for performance and fault isolation, proposed ATE/UUT interconnection diagrams, UUT failure profiles, and a list of potential problems with recommended solutions.

2.3.1.1 Test Requirements Analysis

The contractor shall review the failure-mode data and perform a test requirements analysis for each UUT. The analysis shall define what constitutes a failure on the basis of the UUT's permissible operating conditions or component tolerances. The results of this analysis shall be included in the initial submission of the TDID. The criticality and frequency of each failure class shall be addressed to guide the TPS design engineers in their efforts for designing and implementing the TPSs. TPS design and testing shall be planned to implement the maintenance concepts of the UUT Integrated Logistic Support Plan.

On the basis of the intended use of the TPS and the maintenance concept formulated for the UUT, the Government will specify in the contract the extent of performance and/or diagnostic testing and the requirements

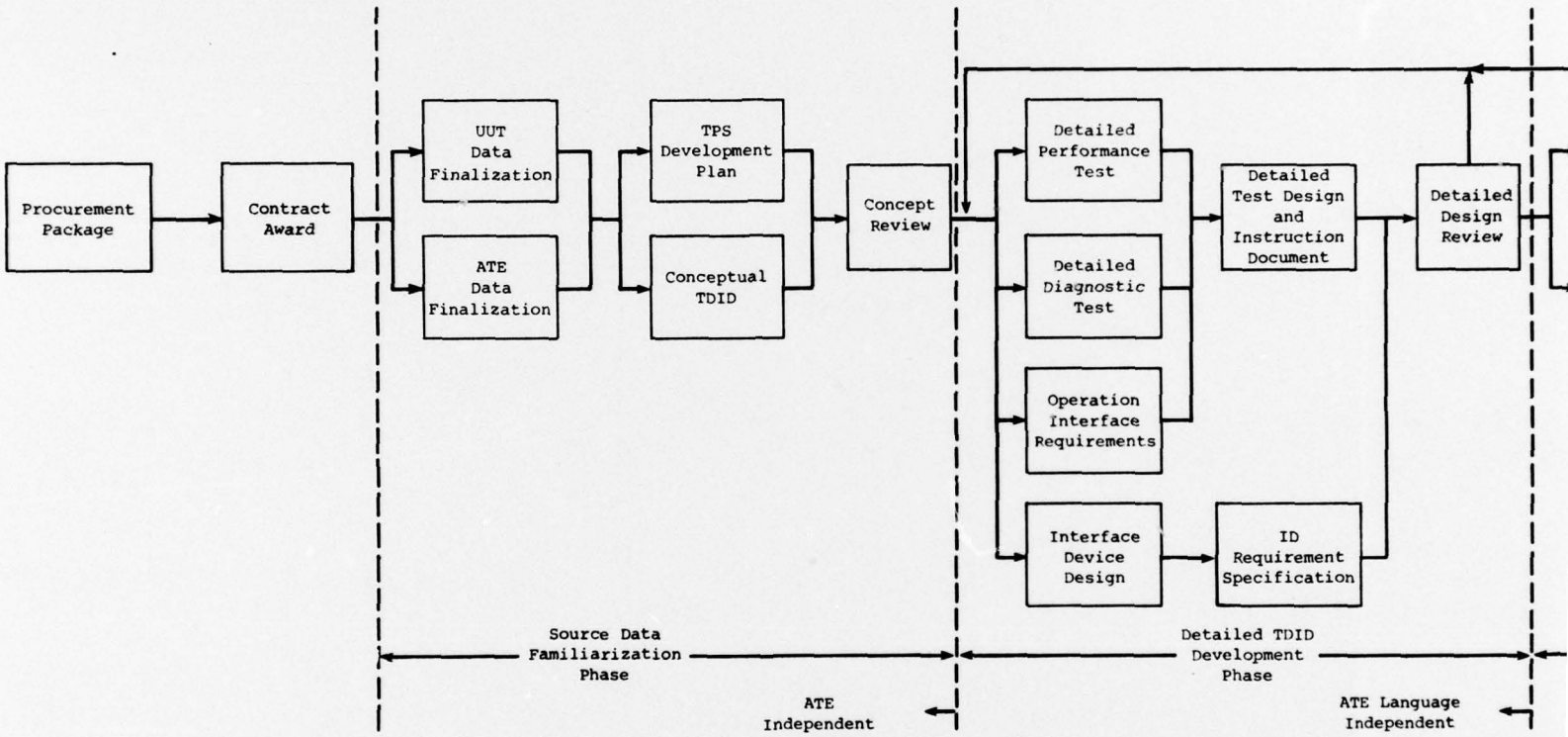
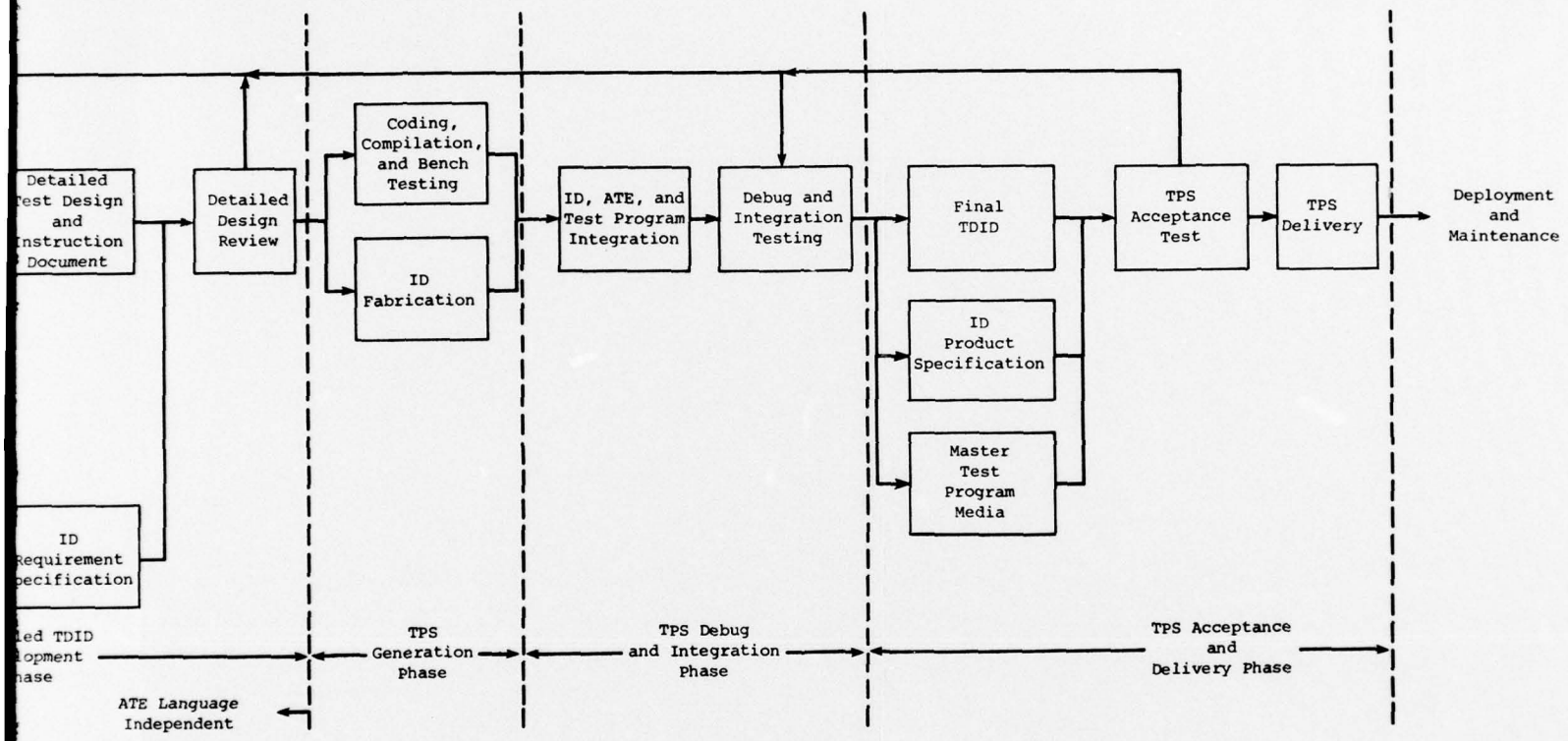


Figure 2-1. TPS DEVELOPMENT PHASES (LIMITED DATA AVAIL



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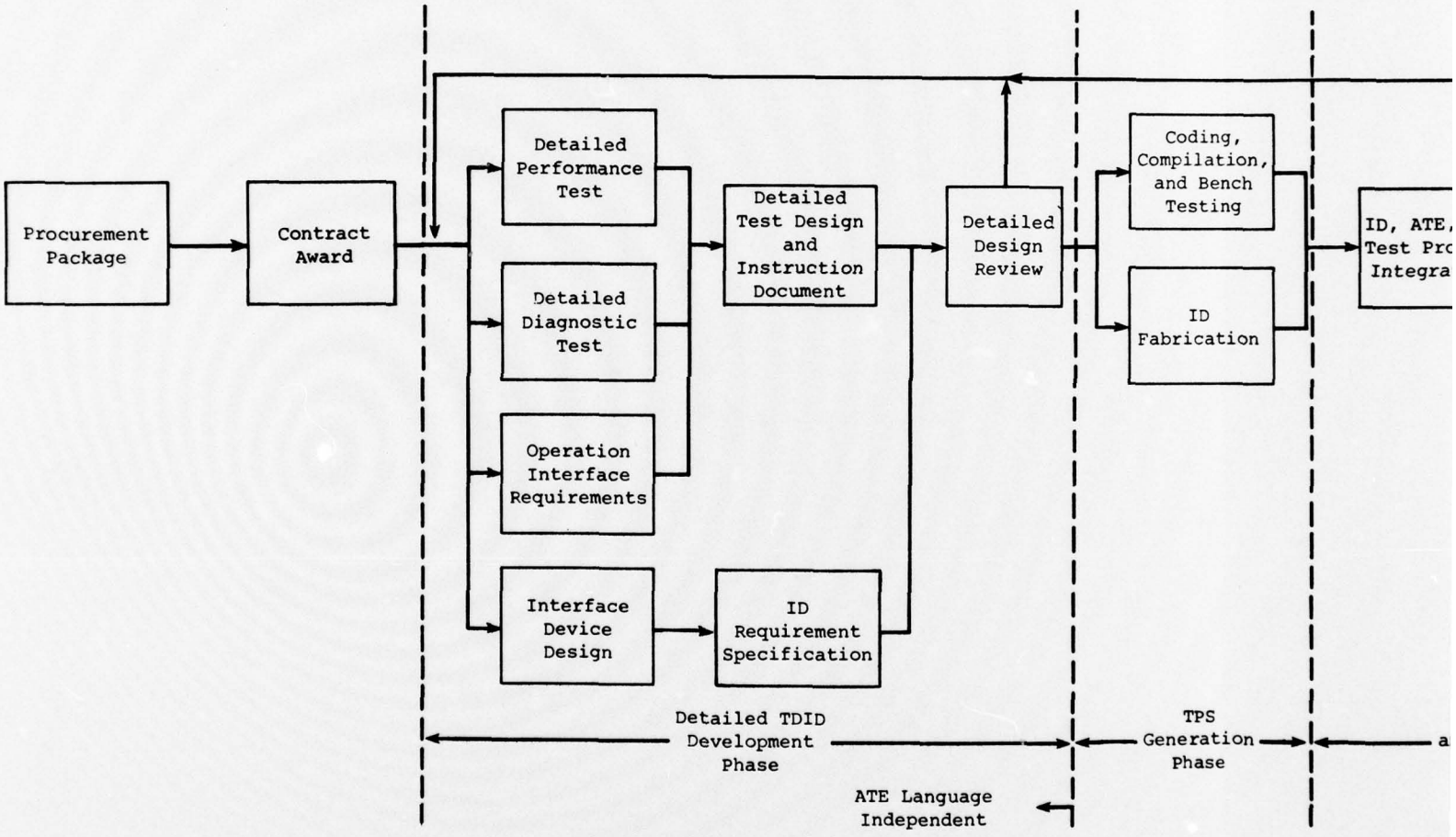
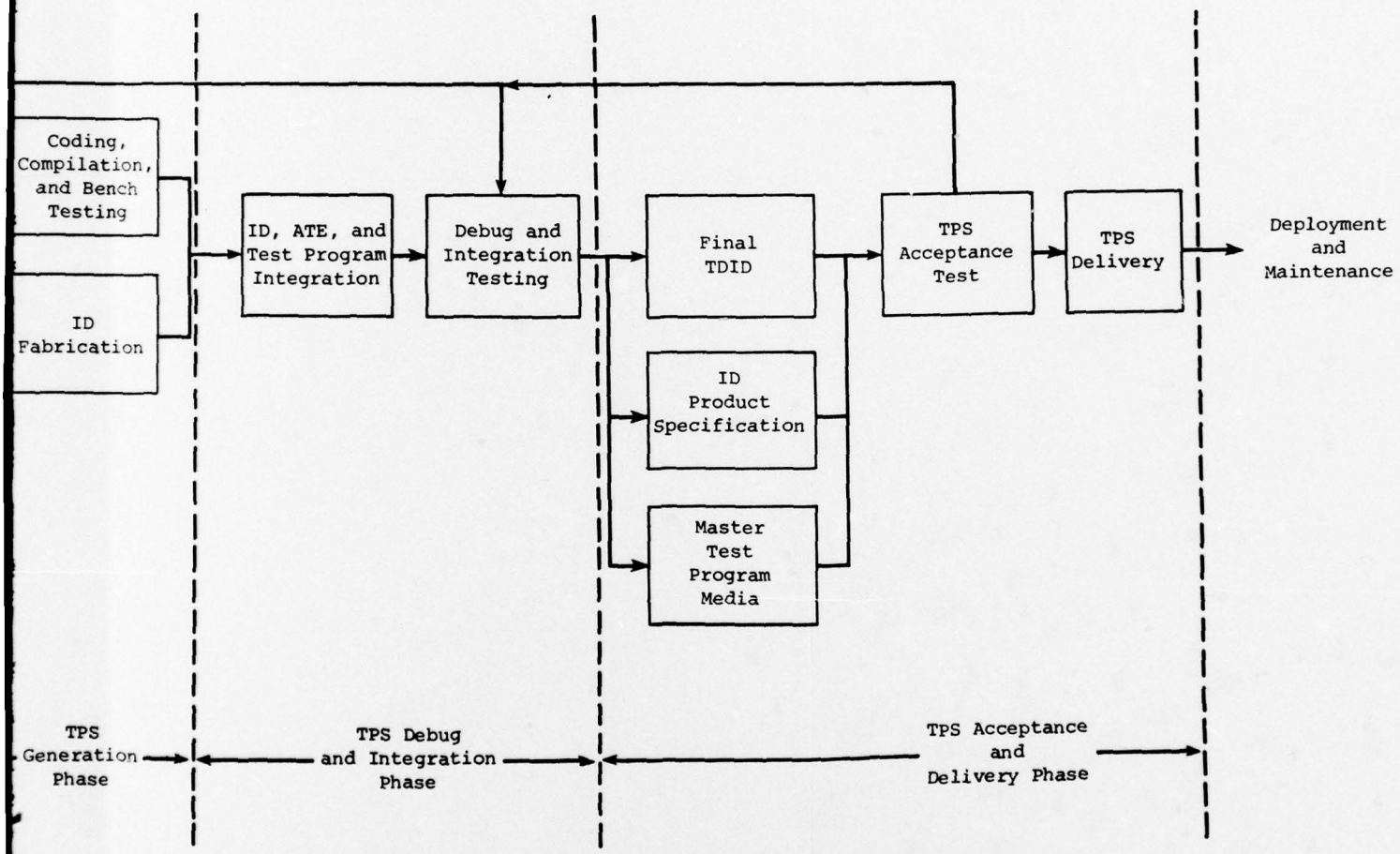


Figure 2-2. **TPS DEVELOPMENT PHASES (COMPLETE DATA AVAILABLE**



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for testing at environmental extremes. However, all TPSs shall perform an ID identification before performing the tests on the UUT.

2.3.1.2 Concept Review

The concept review is conducted to evaluate the TPS Development Plan and the proposed test strategy contained in the conceptual TDID established by the test engineers before development of detailed test design data. The Government's participation in this review, as well as the later detailed design review, debugging and integration, and acceptance testing phases (as described in the following subsections), will ensure high confidence that the delivered TPS will satisfy contract performance requirements.

2.3.2 Phase II -- Detailed Test Design and Instruction Document Development

Upon approval of the conceptual TDID by the Government, the contractor is authorized to proceed with the design of the test. A detailed TDID shall contain the sequence of tests, a description of the test setups and adjustments, and detailed ATE/UUT interconnection diagrams.

2.3.2.1 ID Identification Tests

The contractor shall develop ID identification tests to verify that the correct interface device is installed and connected properly. Failure of this test shall result in a message to the operator identifying the failure and termination point of the test. A separate ID identification check is required for this test. This check should be made of a component value that is not a function of electrical current (e.g., at a resistor rather than a diode). "Open" shall not be used for ID or ID/UUT identification. "Short" will be acceptable where no passive components are available. Where possible, this check shall identify the various revisions of the basic part number. The operator shall be instructed to identify the UUT visually. The program shall then await operator identification before proceeding to other tests. If there is a possibility of test conditions that could damage the ID, UUT, or the ATE, a "safe-to-turn-power-on" test shall be performed first.

2.3.2.2 ID Tests

IDs are considered to be the same as any other UUT and shall have a complete TPS developed for them. The software test program for the ID shall contain two paths from which to choose: (1) a complete performance test of the ID and (2) a survey test having sufficient detail to give a high confidence that the ID is performing properly.

2.3.2.3 Performance Test Program

The performance test program is a discrete set designed to determine that the UUT is performing within specified tolerance limits. Performance tests shall be sufficiently detailed to ensure that defective units are not accepted and that acceptable units are not rejected. The performance program shall store and display all relevant test instructions and test results

needed for statistical analysis in accordance with Section 2.4.4. Display of test instruction data may be inhibited by the operator at his option.

Performance tests shall always start with a set of static checks, consisting of various impedance measurements to test for open or short conditions of power supply, bias lines, and relay coils.

For digital UUTs, performance testing shall be performed at operational clock and signal rates where possible. Operational rates are those of the UUT in its normal operational environment.

If the test design engineers foresee a high probability of independent failures in that UUT and believe that continuation of the test will produce useful data, performance testing may continue after a failure. When multiple faults occur, an attempt shall be made to identify the most probable cause of the failure. A successful performance test shall result in a printout of the appropriate messages and an end to the test. Following detection of faults, the TPS may enter diagnostic testing unless the ATE operator indicates otherwise through switch or "flag" settings.

2.3.2.4 Diagnostic Program

The diagnostic program will identify faults, guide the operator in probing if necessary, and isolate the faults to the next lower assembly level or defective component. The Government will specify the level of fault isolation required and the method of fault isolation (guided probe, multiple probes, etc.) for each UUT. Diagnostic programs shall be designed to minimize operator participation, including manual probing. If isolation cannot be accomplished below a cluster of piece parts, an analysis shall be required for limiting fault isolation to such a cluster, including specification of the cluster size. Each piece part of the cluster shall be ordered in descending probability as the potential cause of failure. Manual or guided probing shall be kept to a minimum. Diagnostic testing that requires the ATE operator to isolate the faults by opening signal paths must be separately identified and approved by the Government. Multiple faults should not be considered unless they are independently detectable at the output.

2.3.2.5 Alignment Tests

Alignment tests may be part of the performance tests when alignment is a part of UUT performance. For example, alignment of a PCB is permitted during the PCB testing; however, when that PCB is part of an LRU, a need to remove and align the PCB prior to completing the LRU test shall be classified as a failure.

The range of alignments should not be checked unless adjustment is necessary for the UUT to function properly in the next higher assembly level. When such alignment is made, testing shall not continue if the resulting position of the adjustment device is at one end of its range.

2.3.2.6 Accuracy Requirements

The allowance for measurement uncertainty is usually permitted by using techniques such as averaging or root-mean-square. These allowances will not be necessary if the test instrument uncertainty is no greater than one-third of the parameter tolerance permitted for the UUT.

2.3.2.7 Detailed Design Review

At the completion of this phase, a detailed design review shall be held. This second major review will be conducted by the Government and will check the TDID technical content to determine coding readiness. The Government technical representative will have the authority for approval of the detailed design.

2.3.3 Phase III -- TPS Generation

The actual coding of the test sequences and the fabrication of the interface device shall be initiated only after Government approval of the detailed TDID. The contractor shall comply with the Government standards for coding and documentation as stated in the contract. The TDID shall contain documentation for use and maintenance of the TPS, including operator instructions for set-up, execution, and tear-down procedures; identification of support equipment; and safety and other precautions.

2.3.4 Phase IV -- *TPS Debug and Integration*

Before the TPS is loaded on the ATE, the contractor shall conduct a review to verify that the TPS, both software and ID, is ready to go on station. After the TPS has been integrated with the ATE, the contractor will check the performance of the program by deliberately inserting known faults, which have been agreed upon, into the UUT. Any errors encountered shall be noted and appropriate corrections made to the TPS. Records shall be kept of all fault-insertion and testing activities in a certified log-book, which shall include a record of the time expended on the ATE or development stations, number and description of faults inserted and isolated, corrections made to the TPS, and any problems encountered during the tests.

Government personnel will witness this fault-insertion testing. Their observations will form the best historical data on the TPS performance and will affect the Government confidence in the final product.

2.3.5 Phase V - TPS Acceptance and Delivery

At the conclusion of the Debug and Integration Phase, the contractor shall formally notify the Government that the TPS is ready for acceptance and shall provide to the Government all materials to be used in the demonstration. The Government will review the submitted material for completeness and correctness and will participate in the demonstration, including fault insertion. As set forth in the TPS contract, the Government will require the contractor to perform environmental testing to simulate the intended deployment environment (depot, general support, direct support, etc.). (See Subsection 4.1.1.2.)

2.3.5.1 Safety

In the design of the TPS, the contractor shall identify all possible hazards, including high voltage, fire, shock, temperature extremes, mechanical, and radiation (electromagnetic and nuclear) and shall minimize their effects. All ATE operations, maintenance personnel, the UUTs, and the IDs shall be protected from these hazards. Appropriate and adequate warnings shall be provided for hazard avoidance. Messages shall be displayed to the operators prior to all hazardous steps in the test procedure clearly describing the types of hazards involved and instructing the ATE personnel, step-by-step, on how to test hazardous UUTs.

2.3.5.2 Security

Contractors will be advised of the security classification of each UUT and its associated TPS and the appropriate security regulations that should be followed.

2.3.5.3 Warranty (Where Used)

The contractor shall warrant TPSs for a period specified by the contract. The warranty shall protect against failures subsequent to acceptance, as follows:

- To detect or diagnose a fault specified in the TRD, TDID, or Test Plan
- To comply with safety, reliability, maintainability, and design requirements, and the requirements of the Test Plan

The Government will notify the contractor of such failures and the contractor shall, with Government approval, correct these failures at his place of business or at Government sites in a timely manner, generally within 15 days of notification. All costs associated with these repairs shall be borne by the contractor. The method of acceptance shall be specified by the Government.

Where a unit of a particular configuration was not supplied to the contractor for evaluation during development of TPS, those aspects of the applicable portion of the TPS will be exempt from this warranty.

2.3.5.4 Equipment Requirements

The contractor shall identify in his proposal the Government-furnished equipment (GFE) and related logistical support requirements for TPS development, including UUT, ATE, and computer resources. He shall also identify schedule usage for each item of equipment. The Government will provide sufficient numbers of UUTs for TPS development and validation in a timely manner.

Except for the GFE specified in the contract, the contractor shall be responsible for furnishing all necessary personnel, facilities, and

equipment for planning, development, testing, and acceptance of Test Program Sets.

2.4 TEST PROGRAM SET DESIGN

2.4.1 General Guidelines

The test program shall be functionally modular with separate independent test program modules performing individual or sets of discrete tests. The test program, as well as the modules within each program, shall be designed so that the natural reading of the code text shall follow the control flow of the test design and the UUT functional organization, i.e., top down. Control architecture, interfaces, and data flow between the lower- and higher-level modules shall be designed before the definition of lower-level test modules. Modules shall have a minimum number of entry and exit points and shall be of minimum size.

A standard module format consistent with the implementation language shall be devised to facilitate reviewing, debugging, and servicing. A suggested module format is name, header comments, macros, pseudo-operations, code, constants, local variables, and end. Interdependencies of modules that could result in the "ripple" effect (changes in one module causing errors in other modules) should be minimized; therefore, independent modules are preferred.

Entry points shall be provided to permit maintenance personnel to enter the test procedure for performing selected groups of tests. Special attention shall be directed toward exercising UUT/ID identification safety tests and initializations, as appropriate, at the various TPS entry points.

Whenever structured control elements are provided in the ATE language used to write the TPS, the contractor shall utilize structured programming techniques -- "Sequence", "Do While", "If-Then-Else", and similar branching techniques -- and shall restrict the use of unconditional branch and jump (GO TO) instructions for instances such as error processing and abnormal exits from the program.

Sufficient comments, including name, function, programmer, date accepted, and major revisions, shall be provided to facilitate TPS status reviews and maintenance. Each major subfunction, test, or program procedure shall have comments describing the function that follows.

Test programs should be designed so that, as a goal, no more than 80 percent of the computer resources (storage, cycle time, I/O capability, etc.) would be utilized at any time during testing.

The program shall, at the conclusion of testing, electrically disconnect all stimuli and measurement devices from the UUT.

2.4.2 Interface Devices (IDs)

The interface devices, including all cables and connectors required to connect the UUT to the ATE, shall be designed in accordance with MIL-STD-785A, MIL-T-21200, MIL-T-28800A Type II equipment, and the guidelines discussed in this section. The number of IDs for each UUT shall be kept to a minimum. Contractors are required to perform an analysis to determine the optimum number of required IDs for testing a given number and type of UUT. Depot, general support, direct support, storage and handling, and transportation requirements should be considered in this analysis.

2.4.2.1 ID Design

ID design shall minimize operator set-up time and potential operator errors during set up and tear down. The ID design shall not degrade any UUT performance parameters. With the exception of transformers, all components in the ID shall be derated by a factor of two. The contractor shall select components for use in the ID of the same qualification level as those used in the UUT. The components shall be mounted so that it will not be necessary to disassemble large portions of the ID for servicing and maintenance.

2.4.2.2 Reliability

Where environmental and usage factors are required, IDs shall be designed in accordance with the applicable portions of MIL-STD-785A, depending on the complexity of the ID. Combined MTBF for all ID elements necessary to test a single UUT shall not be less than the number of hours specified in the contract, calculated in accordance with MIL-HDBK-217. Reliability demonstration requirements shall consist of testing all IDs for contract-specified numbers of consecutive failure-free hours in the environment.

2.4.2.3 Maintainability

IDs shall be designed for testing on the ATE, using loop-back cables and other shorting devices provided by the contractor as part of the TPS deliverable. For simple passive IDs where continuity can be easily checked by using a multimeter, no loop-back devices shall be required. For IDs containing active components, the TPS shall be capable of fault-isolating the ID, thereby treating the ID as a UUT. All adjustments, alignments, and calibration requirements of the ID shall be included in the TPS.

The contracting officer will specify the applicability of MIL-STD-471 to the maintainability demonstration of the ID.

2.4.2.4 Physical-Mechanical Considerations

ID design shall conform to the following:

- Title 29, Code of Federal Regulations, Chapter XVII, Paragraph 1010, "Occupational Safety and Health Standards"

- MIL-STD-454, Requirement 1
- MIL-STD-1472, Requirements for Weight, "Labeling" (Paragraph 5.13), "Color Coding of Indicator Lights" (Table 1)

The mechanical design shall be appropriate to tolerate the heavy usage expected. All connectors shall be in accordance with military standards and shall be provided with protective covers.

2.4.3 Language

The entire test program shall be written in the test language specified by the Government. Advance approval will be required for use of any language other than that specified for any portion, segment, or subrcutine of the TPS. The contractor shall provide a detailed impact analysis on life-cycle cost, testing, and maintenance when requesting permission to use other languages. Moreoever, requests for deviations shall be treated and submitted as Engineering Change Proposals (ECPs).

2.4.4 Operator Interface

Communication with the ATE operator shall consist of messages displayed on the ATE printer and/or console display unit(s). TPSs shall offer the options of printing the TPS/UUT identification numbers, revision numbers and date or program compilation, the basic data of the tests being performed, and the failure condition(s) or success of these tests on the logging device. These options will improve traceability and provide a record for assessment of the test station performance. Additional messages, including both results of the measurements and calculations, shall be available to the operator at his option. Set-up instructions shall be displayed.

Repair and assembly/disassembly information, complex pictorial data, and waveforms shall be furnished in the TPS documentation. The displayed messages shall cite the appropriate test numbers in the TDID and/or test program listing. When standard display messages are provided by the Government, the contractor shall use them whenever applicable.

Instructions for probing, alignment, and warnings, in addition to cautions and switch setting actions on the UUT, shall be displayed. Probing instructions shall be available for reference by the repair personnel, and warnings and cautions shall also be displayed.

2.4.5 Design Aids

Contractors shall obtain prior Government approval for development of software production or programming aids.

To reduce the cost of TPS development, contractors are encouraged to use Government-owned support software including syntax checkers, LASARs, pin list generators, and library maintenance programs. Bidders shall identify the Government-owned support software packages they will require as identified in Subsection 2.3.5.4.

2.5 TPS ACCEPTANCE

TPS acceptance will be on the basis of several evaluations. Acceptance tests shall be conducted by using TPS deliverable data items and ATE equipment that are in correct working order and current calibration status. With the exception of UUT and ATE documentation, all tests shall be conducted without reliance on any documentation that is not a part of the TPS. Whenever such equipments are available, acceptance tests shall be performed on ATE and UUTs other than those used by the contractor for TPS development. At the Government's option, TPS acceptance tests may consist of any or all of the following tests. Any discrepancy between the delivered TPS and any requirement of the specifications shall be cause for TPS rejection.

2.5.1 Performance Test

Each TPS shall undergo a complete performance test sequence (i.e., "GO" chain) on a known good UUT. The Government may reserve the right to run the "GO" chain up to four times to demonstrate repeatability.

2.5.2 Fault-Insertion Test

Government personnel will, on the basis of TPS development data, determine the type and the number (up to the maximum allowed in the contract) of faults to be inserted in the UUT.

Following each fault insertion, the TPS shall be exercised and the results documented. At the Government's option, the fault shall be removed and the TPS rerun to verify the proper UUT operation. If any faults are not detected or isolated properly, the contractor shall take corrective action, including revalidation of previously undetected faults.

2.5.3 Every Program Path Test

Every path in the program ("GO" chain, all abnormal processing, diagnostic, alignment/adjustment, and housekeeping function) may be exercised. These tests may be accomplished by inserting faults or otherwise simulating the abnormal conditions. Government personnel may, at their option, require up to 100 percent of the TPS statements to be exercised for correctness and validity.

2.5.4 Other Tests

The Government may require TPS acceptance testing to be performed in its depot or under environmental conditions resembling those for which the TPS is intended to be used and as specified in the contract.

"GO" chain and fault-isolation routines and their compliance with contractual requirements will be evaluated. In addition, test program structured design, modularity, and readability will be reviewed by the Government and their acceptability will be determined; operator interface communications adequacy will be evaluated; and safety features meeting the appropriate safety requirements stated in this document will be reviewed.

2.6 DELIVERABLES

The following subsections address two classes of deliverables that shall be required -- TPS usage deliverables and TPS maintenance deliverables.

2.6.1 Usage Deliverables

TPS usage deliverables shall be provided for each UUT and shall consist of the following:

- Documentation shall be in accordance with the contract data requirements list (see Appendix D).
- An interface device (ID) shall be used for interfacing the UUT with the ATE, including all cables, connectors, and ID self-test cables, if any. A number of TPSs may use the same ID.
- Program object code and/or intermediate instructions shall be delivered on the medium (mylar tape, magnetic tape, cassette, floppy disk, hard disk, etc.) specified by the Government and in a format compatible with the ATE. The program object code and/or intermediate instructions shall be complete with all necessary subroutines and shall be ready for loading on the ATE. They shall not require any other programs or software for their execution other than the normal operating system and runtime software of the ATE configuration for which the TPS was written.

2.6.2 Maintenance Deliverables

TPS maintenance deliverables consist of any and all special equipments, cables, and tools (hardware or software) necessary for maintenance of the TPS. These deliverables do not include general-purpose equipment such as multimeters, oscilloscopes, etc., that are generally found in the Government maintenance centers and depots.

In addition to the source decks and listings, all computer programs, programming packages, and programming aids developed or procured at Government expense for planning, development, production, test, maintenance, and acceptance of the TPS shall be deliverable items. Complete documentation for these software programs shall also be deliverable.

In addition, the contractor shall supply a list of all computer programs used in any of the various stages of the TPS development that are not developed at Government expense. The list shall identify each program by name, revision number, manufacturer, machine, and configuration (hardware and software).

CHAPTER THREE

TPS USAGE GUIDELINES

This chapter provides guidelines for the use and maintenance of Test Program Sets. These guidelines are intended for use by Project Managers and logistic support organizations and by contractors providing TPS usage and maintenance training and support services.

3.1 OPERATIONS ORGANIZATION

The recommendation is made for establishing a centralized TPS support engineering organization, having a central core of experts with the authority to hire qualified personnel from other sources to augment their capabilities during peaks. It should consist of a TPS Organic Maintenance Group and a TPS Analysis Group. This organization could support many production testing groups, each supporting one or more ATEs and/or commodities. The functions of each group including the operator function are discussed in Appendix F.

The establishment of a single centralized TPS configuration and maintenance management facility, which supports a number of ATEs and material commands, is necessitated by the large number of TPSs that will be in the inventory in the immediate future. Primary benefits from this facility will include the following:

- TPS Compatibility with ATE. The management facility will be manned by a central core of experienced personnel familiar with ATE capabilities to ensure that TPSs designated for a given ATE will not exceed its performance limits.
- TPS Distribution Control. The facility will distribute TPSs and TPS changes to the maintenance installations.
- Historical Record File. The information specified in Chapter Four, Subsection 4.1.3, will be gathered and stored at this facility to provide a single data base for a TPS effectiveness analysis and future TPS improvements.

The management facility will receive all proposed ECPs and software change proposals and will ensure their distribution to all affected organizations for response within the specified time limits.

3.2 DATA COLLECTION REQUIREMENTS

A data base shall be established and maintained by the TPS Analysis Group consisting of TPS quality and performance, development, and maintenance cost data. Data may be collected manually by using data collection forms or by automatically using the ATE and management information system program outputs. It is recommended that data should be collected and reduced automatically, and only summaries of pertinent data files should be retained in the data base -- avoiding the need for handling and storing huge volumes of raw data.

Since free-form information and comments are extremely difficult to tabulate, care should be exercised in standardizing the data formats and minimizing comments. While standardization will not be a function of the TPS management organization, the terms used in the data collection system must be clearly defined.

3.2.1 Data Required

Table 3-1 lists the minimum data necessary for TPS maintenance analysis. Some data will be provided by the data forms for configuration management addressed in Chapter Four of this document.

3.2.2 Data Collection and Processing Tools

Methods and programs shall be developed to summarize and store the data collected in the data base with multiple-key access facilities for easy retrieval. The developed system shall maintain sufficient flexibility to permit collection of different data types from the various generations of ATE and TPSs. It shall have the capability to normalize or restructure the data for useful comparison and systematic storage and retrieval. Development of a "data definition language" for TPS data collection is highly recommended. This language would specify the formats, length, keys, and structure of the data items residing in the data base and would have the facilities to create, update, and delete the data items. Other features such as data editing, security for protection against loss of data, and access and change authorization may also be implemented.

Data collection tools shall provide the facilities for reporting the status and activities of the data base, including data base utilization, loading, total number of records, and resource availability and shall summarize the various file entries.

3.3 TRAINING REQUIREMENTS

3.3.1 Operator Training

Operator training shall consist of the following:

- High school education or equivalent
- Basic electronics training, formal or on-the-job

Table 3-1. DATA REQUIRED FOR MAINTENANCE ANALYSIS

Data	Description
TPS ID	Federal Part Number, other ID Number
TPS Date	Date TPS was accepted and released for use
Project and Material ID	Name or acronym of the Project (e.g., PATRIOT, TACFIRE) and the subsystem (Radio, Computer, Radar)
ATE Identifier	ATE and configuration information
Language and Compiler ID	Identification of the compiler, including revision number
Simulator/Support Software	All programming and simulation aids used in TPS development
Initial TPS Contractor	Initial developer of TPS -- contractor or Government organization
Subsequent Contracts	One entry for each subsequent contract identifying the contractor and the date
Cost	Cost of contracts with dates
Comments	General comments regarding this TPS, if any
Program Size	Size of the test program and tables in bytes
Number of Problems Reported	Number of problems reported that have not been identified as invalid with identification of outstanding problem reports
Problem Reports	One entry per problem report identifying errors, discrepancies, etc., reported including date reported
Number of Change Orders	Number of change orders already implemented
Organic Changes	One entry for each organic change request
TPS Warranty	One entry for each warranty action request
Frequency of Usage	Hours per year
Relationships With Other TPSs	Relationships with other TPSs, including sharing IDs or program subroutines or segments
Management Techniques	Management techniques such as top down/ structured design, and chief programmer team

- ATE operator training, equivalent to the course normally offered by the ATE manufacturers
- TPS operations training courses for each group of TPS families or commodities -- these courses, whether offered by the TPS contractor or the Government should assure that following its completion, the operator will properly select the TPS and the ID for each UUT and perform all necessary testing, as well as conduct ID maintenance

Additional commodity-peculiar UUT training may be required to provide the operators with sufficient UUT knowledge to resolve most ambiguities in identifying the UUT, ID, or the ATE as the source of the faults. Operator training periods should be short (8 to 120 hours) and should be limited to those skills necessary for ATE and TPS operational functions.

Lead operators and test supervisors require the same training as the operators, in addition to at least four years of hands-on ATE operation experience.

3.3.2 Engineering Personnel Training

It is recommended that all engineers, programmers, and analysts in the TPS maintenance organization obtain TPS development and validation experience through on-the-job training. Those engineering personnel who have not developed and validated several TPSs should be given the opportunity to do so in the Organic Maintenance Group before joining the TPS Analysis Group.

CHAPTER FOUR

CONFIGURATION MANAGEMENT GUIDELINES

4.1 GENERAL REQUIREMENTS

This chapter provides guidelines for management and technical personnel who are planning, procuring, managing, or conducting configuration control of TPSs. Configuration management procedures should be required and documented for the identification, control, updating, and accounting for the status of Government-accepted TPSs. Specific requirements for a configuration management system are described in this chapter.

4.1.1 Configuration Management within TPS Life Cycle

TPSs are part of an integrated ATE-UUT support system consisting of both hardware and software elements whose configuration should be identified and controlled systematically and consistently. This management is necessary to assure mutual compatibility of elements during the development and production of the TPS, UUT, and ATE. The implementation of configuration identification and control of all TPS elements is prescribed by the guidelines addressed in the following subsections.

4.1.1.1 Baseline Descriptions

A baseline must be established for the control of changes to TPS elements. Many direct interdependencies are involved in establishing such a baseline; but once established, this baseline, in addition to subsequently approved changes, will identify the current configuration.

Three interrelated baselines should be considered -- ATE, UUT, and TPS. When a TPS is developed for fielded equipment, the UUT baseline has already been established by production drawings and specifications, and formal ECP procedures (in accordance with MIL-STD-480) should be in effect. For UUTs that are currently under development and that will require the availability of TPSs when fielded, there may be no formal UUT product baseline. To minimize the effect of frequent UUT design changes on TPS development, it is recommended that TPS development be initiated at the latest possible date commensurate with maintaining schedule requirements (e.g., DT/OT II card and module repair requirement). A similar problem exists when the ATE is under development. It is recommended that TPS development should not progress beyond the conceptual design phase. The TPS contractor may initiate

activity up to the detailed design review of the TPS without having access to an ATE. Before that review, the Government will have determined that the ATE design is available and that it will be certified when the TPS contractor is ready to initiate coding.

Change control procedures and documentation for UUTs and ATEs shall be in accordance with MIL-STD-480. These changes are described in subsequent subsections.

4.1.1.2 Reviews and Audits

For TPS development, three Government reviews (as a minimum) are required to assure adequate visibility, early problem identification, and control of the contractor's performance. During these reviews, Government approval will be required for selected data items, describing the contractor's current TPS design (see Subsection 4.1.2).

Concept Review

The concept review will be held after the TPS contractor has formulated the test strategy and has submitted to the procuring activity the preliminary Test Design and Instruction Document (TDID) and TPS Development Plan. (See Appendix D for detailed descriptions of data items.) During the review, at least the following items shall be discussed: functional description of UUT, design philosophy, UUT documentation problems, test requirements analysis, accuracy requirements, use of standardized test, failure profile, possible performance and diagnostic tests, ATE compatibility with the test requirement, and preliminary ID performance and design requirements. In addition, basic software design characteristics (e.g., top-down structured code, available storage, memory maps, timing and sizing data, and operational interfaces) shall be reviewed.

The information for this review will be contained in the TPS Design Plan and the preliminary TDID as shown in Appendix D. In addition, any existing documents that have been or are planned to be used by the TPS contractor shall be made available for review by the procuring activity.

Detailed Design Review

The detailed design review will determine the status of the conceptual design and the preparedness of the TPS contractor to proceed with coding. This review will be held after completion and submittal of the detailed TDID and preliminary TPS test plans and procedures, and it will ensure that the criteria established at the concept review have been implemented.

The engineering design of the TPS ID hardware shall be presented to the procuring activity in the form of functional block diagrams, engineering drawings, schematics, and possibly mock-ups. The technical justification for the number of proposed IDs shall be presented. The plan for meeting the performance and design requirements established during the concept review shall be indicated.

Detailed English-language procedures and functional flow charts shall be prepared for review to establish the compatibility of the TPS with the Test Requirements Document. Test plans and procedures will be reviewed for satisfaction of the fault-detection and -isolation requirements of the TPS. Computer loading, processing time, and memory estimates will also be reviewed.

At the successful completion of the detailed design review, the Government will grant the TPS contractor permission to proceed with coding.

Formal TPS Acceptance

The final TDID, acceptance test plan and procedures, ID manufacturing drawings, source listings, and object code will be delivered to the Government at least 15 days before the TPS acceptance test. A meeting will be held to discuss the general guidelines and procedures to be used during acceptance testing and to review the delivered documentation in accordance with contract requirements. Upon concurrence by all parties, a fault list shall be provided by the procuring activity to the TPS contractor.

Acceptance by the Government of the TPS will be contingent upon the satisfactory performance of the TPS elements (program, ID, and TDID). The Acceptance Test Procedure (ATP) shall define the procedures to be followed for demonstrating the TPS capability to achieve fault detection and isolation to the contractually specified levels.

Representative faults chosen by the Government to encompass a majority of typical maintenance actions will be inserted into the UUT. Fault insertion will be witnessed by the procuring activity representative, who will record the nature and accuracy of the fault insertion in the ATP data sheets.

A post-demonstration meeting shall be held to discuss the Government's acceptance or rejection of the TPS. If the TPS is rejected, the alternatives will be discussed and a course of action will be recommended by the Government. The recommendation may include redesign or rework of the TPS.

4.1.1.3 Change Control and Updating

All elements of TPSs shall be subject to formal engineering change control procedures in accordance with MIL-STD-480. Special configuration control procedures for software-only changes shall be in accordance with Section 4.3 of this document. During the TPS development cycle, it is the responsibility of the TPS contractor to use the procedures prescribed in the TPS Development Plan to assure that the TPSs for the UUT and ATE systems are correct when submitted for acceptance testing. After formal acceptance, compliance with the procedures described in Sections 4.2 and 4.3 will be required.

When engineering changes to the UUT for which TPSs have been developed create a new part number for the UUT, an additional TPS must be developed for the new part number. No TPS will be removed from the TPS library for

any specific UUT until all UUTs of that type in the inventory become inactive. All TPS modifications shall meet all of the requirements of these guidelines.

When the TPS contractor is authorized to implement modifications to TPSs that have been accepted by the Government, the following requirements for preparation shall apply in order of preference:

1. Utilize the existing ID without modification
2. Utilize the expansion capability of the ID without affecting its capability to test other UUTs for which it was designed
3. Develop a new ID

4.1.2 Documentation Requirements for TPS Life Cycle

To establish TPS configuration control, a complete chain of documentation shall be identified that determines the TPS requirements and design. This chain starts with the identification and control of the UUT as a configuration item in accordance with MIL-STD-480 and the certification of the UUT's designated ATE.

4.1.2.1 Test Requirements Document (TRD)

A TRD shall be developed specifying test requirements for a UUT in terms of its functional, electrical, and mechanical interfaces and providing a complete description of stimuli, loading requirements, and responses. This document shall be written by the UUT contractor for approval by the Government.

After approval of the TRD, the formal UUT baseline for TPS development shall be established. The UUT source documents shall be appended to the baseline. Change control procedures of MIL-STD-480 shall be observed to ensure that the TRD represents the current UUT configuration.

MIL-STD-1519 provides detailed guidance for the preparation of this document.

4.1.2.2 TPS Development Plan

As part of his proposal response, the TPS contractor shall submit a preliminary TPS Development Plan (DP), which will be completed within one month after contract award and submitted for final approval by the Government.

The DP is the overall plan for developing the TPSs and specifies necessary supporting resources, including identification of the end items to be delivered, the schedule for each, and the related documentation submittals. It shall include details of the development organization and assign responsibility for the design, implementation, testing and integration, hardware and facilities requirements, and procedures for managing and controlling the quality of all aspects of TPS development.

The TPS contractor shall observe the procedures, controls, and methods specified in the DP, but it must accommodate changes in schedules and personnel requirements during the development period. Thus the TPS contractor shall be directed [through the Statement of Work (SOW)] to update the plan as appropriate.

The plan shall be used to define the control procedures for managing design changes before the establishment of baselines (especially the approval of the Test Design and Instruction Document). During ATE integration and fault-insertion testing, the plan shall address the reporting and management of discrepancies discovered in testing, responsibilities for failure analysis and correction, retesting, and control of both the TPS source and object code. An example of a detailed content outline for the TPS DP is contained in Appendix D, Attachment 2.

4.1.2.3 Test Design and Instruction Document (TDID)

The TDID and subsequent updates shall be delivered to the Government at three distinct milestones during TPS development cycle -- before the concept review, at the detailed design review, and before final acceptance testing. The content and level of detail contained in the submittals shall be appropriate to the intended review, as detailed in the following paragraphs.

Conceptual Design Phase

The first submittal of the TDID to the Government shall be within fifteen working days before the concept review. At least the first three sections of the TDID -- Introduction, Test Requirements Analysis (TRA), and Pretest Data -- shall be completed.

The major activity for the TPS contracter before conceptual design will be to analyze testing requirements, to formulate a program design approach for all TPSs that will be developed, and to include this information in the TRA section of the TDID. The TRA section shall consist of but not be limited to the following information:

- The results of an analysis of each UUT to determine requirements for test stimuli and responses, and loading, handling, warm-up, and interface connection requirements
- An assessment of any additional Government-supplied UUT test descriptive documentation (schematics, wiring diagrams, assembly drawings, parts lists, DMWRS, product specifications) required as a basis for test program design
- The anticipated number of functional and diagnostic tests, together with an estimate of the level of unambiguous fault isolation that may be achieved
- A list of the basic test groups and associated rationale for performing these tests
- Identification of unique adapter requirements

Government approval of the conceptual design will be required before proceeding to the detailed design phase.

Detailed Design Phase

The second submittal of the TDID shall be within ten working days before the detailed design review. All major sections of the document shall be submitted at this time, including any revisions to the previous submittal.

A detailed description of the UUT test approach shall be provided in an English-language descriptive format. The description shall include the various test groups and tiers of testing and shall describe the implementation of these tests and any special requirements. All the parameters necessary for the UUT to meet its specification shall be tested, and all specified fault-isolation requirements of the TRD shall be met. Appendix D provides an example of a detailed content outline. Upon approval of the detailed TDID, the TPS contractor may proceed with the coding effort.

Final TDID

Before formal acceptance testing and after internal verification and validation testing has been completed, the updated final TDID reflecting the design of the TPS program to be used during acceptance testing will be submitted. The only major item of the TDID that would not have been required with previous submittals would be the program listings in object and source code.

Upon approval by the Government, the final TDID shall provide, for example, language, flow charts, diagrams, program listings, ATE resource requirements, and program start and maintenance procedures, so that a programmer can locate all program listings, data descriptions, and system and utility features required to follow, understand, and maintain the TPS program.

4.1.2.4 Interface Device Development and Product Specifications

A hardware specification in accordance with contractual requirements shall be prepared and kept current by the contractor. The contractor shall comply with the requirements of MIL-STD-480 with respect to changes to the functional and product baseline.

4.1.2.5 TPS Acceptance Test Documentation

Draft test plans and procedures shall be submitted ten days before the detailed design review. Formal acceptance test plans and procedures shall be prepared and delivered by the TPS contractor to the Government one month before acceptance testing.

The plans and procedures shall establish the operating ground rules for all personnel participating in or supporting the acceptance testing

effort. The rules shall contain specific instructions regarding ATE and related test equipment for the following:

- Insertion of faults
- Performance tests
- Correction of program errors
- Correction of manual procedures
- Correction of ID failures

Upon successful completion of the acceptance test, the contractor shall document the results of all performance and diagnostic tests in an acceptance test report. The report shall also contain the contractor's test results of in-house fault insertion and a log of acceptance activities to form a TPS data history.

4.1.2.6 TPS Software Program-Medium

In accordance with Section IX of the Armed Services Procurement Regulations (ASPR) (as described in Defense Procurement Circular DPC 74-3, 29 November 1974), software shall be procured as a data item. The TPS contractor shall deliver object and source codes to the Government in accordance with Appendix D, Attachment 2.

4.1.3 Historical TPS Reference Document

Figures 4-1, 4-2, and 4-3 illustrate the data that shall be collected for each UUT, ID, and ATE within the inventory to provide the historical data base for TPS studies and analysis as well as change proposal evaluation.

The records shall be maintained and updated by the maintenance facility. During the development stages, the TPS and ATE contractors shall maintain current data for their specific tasks. After acceptance by the Government, the maintenance facility will keep the records current.

4.2 HARDWARE-AFFECTED CHANGE CONTROL

All ECPs that affect ATE or UUT hardware shall be processed in accordance with MIL-STD-480. For UUTs that are tested on ATE, in addition to meeting the requirements of MIL-STD-480 for completion of ECPs, the originator shall include the cost and schedule impact of the ECP on the TPS and ATE.

4.3 SOFTWARE CHANGE CONTROL GUIDELINES

Software change control guidelines apply to modifications to test program software and documents after Government acceptance that are not the results of hardware (UUT or ATE) changes. All modifications shall be performed in accordance with MIL-STD-480 and AR-70-37.

UUT Data

Part Number: _____

Nomenclature: _____

Manufacturer's Name: _____

System Used In: _____

Source Data

Assembly Drawing Number: _____ Rev _____

Schematic: _____ Rev _____

Parts List: _____ Rev _____

Wiring Diagram: _____ Rev _____

TRD: _____ Rev _____

TPS Data

TPS DP: _____ Rev _____

TDID: _____ Rev _____

Program Media: _____ Rev _____

ID Development Specification: _____ Rev _____

ID Production Specification: _____

ID Part Number: _____ Rev _____

ATE Data

Compiler: _____ Rev _____

System Software: _____ Rev _____

Basic Building Blocks: _____

Historical

Trouble Reports: _____ Date/Cause/Effect

Figure 4-1. UUT RECORD

ID Data

Part Number:_____

Nomenclature:_____

Manufacturer's Name:_____

UUTs Supported:_____

Test Programs Supported:_____

Source Data

Assembly Drawing Number:_____ Rev _____

Schematic:_____ Rev _____

Parts List:_____ Rev _____

Wiring Diagram:_____ Rev _____

Development Specification:_____ Rev _____

Production Specification:_____ Rev _____

ATE Data

Compiler: _____

System Software:_____

Basic Building Blocks:_____

Historical

Trouble Reports:_____ Date/Cause/Effect

Figure 4-2. ID RECORD

Change processing is initiated by receipt of program or documentation problem reports, program enhancement requests, or waiver requests. The configuration control board shall review, identify, and recommend a list of changes, together with itemized costs (costs per change or costs for a number of related changes) and pertinent analysis or reasons for each change and testing required to validate the changes where implemented. ECPs will be initiated if necessary.

As many changes as possible that affect the same TPS shall be batched to reduce the implementation and administrative costs. Change requests and cost quotations shall include all necessary updates to TPS documentation.

Following implementation of the changes, the Government will participate in validation and verification testing as required. Upon successful

ATE Data

Part Number: _____

Nomenclature: _____

Manufacturer's Name: _____

Building Blocks: _____

UUTs Supported: _____

TPSs Supported: _____

Source Data

Assembly Drawing Number: _____ Rev _____

Schematic: _____ Rev _____

Parts Lists: _____ Rev _____

Wiring Diagram: _____ Rev _____

Building Block Data: _____ Rev _____

Drawing: _____ Rev _____

Schematic: _____ Rev _____

Parts List: _____ Rev _____

Software Data

Compiler: _____ Rev _____

Assemblies: _____ Rev _____

Operating System: _____ Rev _____

Historical

Trouble Reports: _____ Date/Cause/Effect

Figure 4-3. ATE RECORD

verification, the Government representative will prepare a verification letter for submittal with the developed changes and change instructions. As a result of the changes, a kit, subroutine, and/or newly compiled programs in the appropriate medium, and new documentation and change instructions shall be delivered.

APPENDIX A

DEFINITIONS

Accuracy. The degree to which a measured value agrees with the true value.

Automatic Test Equipment (ATE). Equipment that is designed to analyze static or functional parameters of the units under test (UUT) to evaluate performance and that may be designed to indicate and isolate faults that cause malfunctions in the UUT. The decision-making, control, and evaluations are conducted with a minimum of reliance on human intervention.

Fault. A failure causing a deviation in the specified functional performance of a UUT.

Interface Device (ID). A device or series of devices designed to provide a compatible connection between the unit under test and the automatic test equipment. An ID may include special stimuli or loads that are not contained in the test equipment.

Line Replaceable Unit (LRU). A unit designed in accordance with a maintenance plan to be removed at the organizational level upon failure from a larger entity (equipment, system, etc.) in the latter's operational environment.

Stimulus. Any input applied to a device intended to produce a measurable response.

Test Accuracy Ratio (TAR). The ratio of ATE accuracy to tolerance limits required for simulation and measurement for the UUT.

Test Program Set (TPS). All elements, including hardware, software, and documentation, necessary to permit a unit under test to be tested by automatic test equipment.

APPENDIX B

ACRONYMS

ATE	Automatic Test Equipment
ATLAS	Abbreviated Test Language for All Systems
CCB	Configuration Control Board
CI	Configuration Item
DID	Data Item Description
DP	Development Plan
DS	Direct Support
ECP	Engineering Change Proposal
GFE	Government-Furnished Equipment
GS	General Support
ID	Interface Device
ILSP	Integrated Logistic Support Plan
I/O	Input/Output
LASAR	Logic Automated Stimulus and Response
LRU	Line Replaceable Unit
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
PCB	Printed Circuit Board
PM	Product Manager or Project Manager
QA	Quality Assurance
RF	Radio Frequency
RFP	Request for Proposal
SOW	Statement of Work
TAR	Test Accuracy Ratio
TDID	Test Design and Instruction Document
TPS	Test Program Set

TRA	Test Requirements Analysis
TRD	Test Requirements Document
UUT	Unit Under Test

APPENDIX C

SUGGESTED OUTLINE FOR STATEMENT OF WORK

1. Objective
2. Scope
3. Background
4. Tasks/Technical Requirements
   - 4.1 Design, Fabricate, and Deliver
     - 4.1.1 Design
       - 4.1.1.1 General Design Requirements
         - TPS Development Plan
         - *Safety*
         - Equipment Requirements
         - Discrepancies
         - Language
         - Coding Convention
         - Operator Interface
         - Support Software
         - Design Aids
       - 4.1.1.2 TPS Design
         - General Guidelines
         - UUT Testing Requirements (TPS Design)
           - ID/UUT Identification Test
           - ID Stimuli Tests
           - UUT Performance Tests
           - UUT Diagnostic Tests
           - UUT Alignments
           - Accuracy Requirements

- Interface Device Design
  - Performance Requirements
  - Reliability
  - Maintainability
  - Physical/Mechanical Considerations

4.1.2 Fabrication

4.1.2.1 Hardware Fabrication

4.1.2.2 Software Production

4.1.3 Deliverable Items

4.1.3.1 For Each UUT

- Test Program Object or Intermediate Code
- Interface Device
- TDID

4.1.3.2 Other Documentation IAW CDRL

4.1.3.3 TPS Maintenance

- Source Decks and Listings
- Support Software

4.2 Program Management

4.3 Test and Evaluation

4.3.1 Internal Test and Evaluation

4.3.2 TPS Acceptance Test

4.3.2.1 Performance Test

4.3.2.2 Fault-Insertion Test

4.3.2.3 Program Path Test

4.3.2.4 Run-Time Resource Measurements

4.3.2.5 Environmental Test

4.4 Data Management

4.5 Configuration Management

4.5.1 Baseline Description

4.5.2 Reviews and Audits

4.5.3 General Change Control and Updates

4.5.4 Status Accounting

4.5.5 Baseline Documentation Requirements

4.5.5.1 TDS

4.5.5.2 TPS DP

4.5.5.3 TDID

4.5.5.4 ID Development and Product Specification

4.5.5.5 Acceptance Test Plans, Procedures, and Reports

4.5.6 Centralized TPS Management

4.5.6.1 Historical TPS Reference File

4.5.6.2 Hardware Change Control

4.5.6.3 Software Only Change Control

4.6 Quality Assurance Program

4.7 Warranty

4.7.1 One-Year Warranty

4.7.2 Long-Term Warranty

APPENDIX D

DATA REQUIREMENTS

1. PREFACE

This appendix lists and briefly describes the minimum set of data items required by the Government from the TPS contractor. Existing Data Item Descriptions (DID) have been used to the maximum. Minor modifications may be required for some of the data items to reflect specific Government requirements. For three data items, new DIDs are required; their contents are listed in Attachments 1, 2, and 3 to this appendix. A list of additional data items that may be procured is also provided.

2. REQUIRED DOCUMENTATION

- DI-E-XX - Test Design and Instruction (see Attachment 1 for DID)
- DI-E-YY - TPS Development and QA Plan (Attachment 2)
- DI-E-ZZ - Test Program Set Software Code (Attachment 3)
- UDI-E-20064 - ID Development Specification
- DI-E-3132 - ID Product Specification
- DI-T-3714A - Acceptance Test Procedures
- DI-T-3718A - Acceptance Test Report
- DI-E-3128 - Engineering Change Proposals

3. EXAMPLES OF OTHER POSSIBLE DATA ITEMS

- DI-A-5032 - Project Status Reports
- DI-A-3009 - Program Milestones
- DI-A-3027 - Data Accession List/Internal Data
- DI-E-3127 - Advance Change/Study Notice
- DI-E-3145 - Engineering Drawings for Design, Reviewing, Audits, and Evaluation
- DI-F-6004A - Contract Fund Status Report

- DI-H-3258A - Training Support Date
- DI-H-6131 - Training and Training Equipment Plan
- DI-H-6153 - Technical Manuals/Commercial Literature

ATTACHMENT 1

DI-E-XX

Block 1. Test Design and Instruction Document

Block 3. To specify the complete procedures and test steps, sequence of tests, and test parameters required to isolate faults and verify proper operation of a particular item that is to be tested on automatic test equipment. English-language statements are used in addition to flow charts. The TDIDs will also contain the complete test requirements analysis, program start-up, and operator actions, and the program listing in the ATE higher-order language.

Block 10. See Addendum I attached to this DID.

ADDENDUM I TO DI-E-XX

1. SCOPE

This addendum addresses the preparation of Test Design and Instruction Documents for systems supported by an Automatic Test Set. Each UUT TDID shall contain complete test (automatic and manual) and fault-isolation procedures, as well as a test requirement analysis, pre- and post-test procedures, and source program listings. Each TDID shall contain functional and diagnostic flow charts with English-language test descriptions that are all-inclusive and in a format directly applicable to the coding and preparation of a test program and for qualification test and fault isolation of a specific UUT. Each TDID shall contain the interface requirements between UUT and ATE and shall cite the interface device development and product specifications.

2. RULES FOR PREPARATION OF A TEST DESIGN AND INSTRUCTION DOCUMENT

2.1 Elements of the Document

A Test Design and Instruction Document shall contain document elements in the following order:

- Title Page
- Summary Page
- Revision Sheets
- Table of Contents
- Section 1. Introduction
  - UUT Description and Differences
  - Purpose and Scope of Test
  - Programming Rules
  - Source Information

- Section 2. Test Description and Instructions
  - Pretesting Data
    - ATA Resource Required
    - Support Equipment Required
  - Test Requirements Analysis
  - Program Start Procedure
  - Operator Actions
  - English-Language Test Description
    - General
    - Test Design Criteria
    - Static Tests
    - Dynamic Tests
    - UUT Interface Requirements
  - Supplementary Data
    - Listing
    - Functional Flow Charts
    - Diagnostic Flow Charts
    - Interconnection Diagrams
    - Cross-Reference Table
    - Digital Test Data
- Section 3. Engineering Notes
- Section 4. Quality Assurance

Each of these elements is described as follows:

- Title Page. Figure 1 illustrates a title page for a Test Program Design and Instruction Document.
- Summary Page. Figure 2 illustrates a summary page for a Test Program Design and Instruction Document.
  - UUT Number. UUT identification numbers shall be assigned by the TPS contractor and shall be available on request.
  - Date. Record the date when manuscript typing is initiated, which will provide a base reference for subsequent revisions.
  - Number of Pages. Record the total number of pages in the original manuscript. This number will change as pages are later revised.
  - UUT Nomenclature. For each UUT, record the complete military nomenclature. If military nomenclature has not yet been assigned, use the assembly common name.

- Military Designation Number. Record the Army Part Number for the UUT. If an Army Part Number has not been assigned, record the control number or the manufacturer's designation.
- System. Indicate the system or subsystem of which the UUT is an integral part. Use official military nomenclature when available.
- UUT Serial Number Applicability. Indicate the serial number and model of the UUT used in the preparation of the Test Design and Instruction Document. In addition, indicate the applicability to other UUT serial numbers and models.
- UUT Serial Number at Validation. Record the serial number or serial number range of the UUT to which this Test Design and Instruction Document applies.
- Test Program Status. Record test program milestones such as date of design, validation sign-off, and complete revision sign-offs.
- Revision Sheets. Revisions to a Test Design and Instruction Document shall be recorded on a status table and revision sheet similar to those in Figures 3 and 4 of this addendum. The status table (Figure 3) shall keep a running summary of all revisions. Specific details shall be recorded on the revision sheet (Figure 4). Revisions to a Test Design and Instruction Document shall also be indicated by tagging each revision page with a revision letter in the upper right-hand corner (for example, Revision B). A capital letter shall be used to tag an added page (for example, page 3A, 3B, etc.).

- Table of Contents. Section 2.1 illustrates the high-level table of contents for a Test Design and Instruction Document. Further breakdown of the sections shall be required.
- Section 1 - Introduction. This section shall contain the following information in the order indicated.
  - UUT Description. Provide a brief physical and functional description of the UUT.
  - UUT Differences. If more than one UUT is to be covered in the same Test Program Design Document, the differences between UUTs shall be noted by the use of Army Part Numbers and/or serial number ranges. The test flow diagram shall be designed to reflect these differences.
  - Purpose and Scope of Test. Describe the scope of the test program as well as the overall test philosophy and required fault-isolation levels.
  - Programming Rules. The basic programming rules for the designated ATE shall be contained in its Programming Manual. The manual shall contain general information on the operating characteristics of the ATE assemblies, UUT interface connection

data, and detailed procedures applicable to the ATE test analysis and program structure. State the test program language called for by use of the designated ATE.

•• Source Information. List sources of information, documents, drawings, etc., used in the preparation of the Test Design and Instruction Document.

- Test Description and Instructions

  •• Pretesting Data

    ••• ATE Resources Required. List by assembly number (with title and quantity of all ATE resources required to run the test program).

    ••• Support Equipment Required. List by nomenclature and number any test equipment tools, fixtures, shorting plugs, etc., required in addition to the ATE station and ID (Interconnection Device). Do not list standard tools in the Test Design and Instruction Document.

  •• Test Requirements Analysis. This section shall contain the material required by Subsection 2.3.1.1 of the Guidelines for Acquisition, Use, and Configuration Control of TPSs for ATE.

  •• Program Start Procedure. Provide step-by-step procedures for all unique actions of the test program required to start the test (i.e., entering test program's call-up code). The procedures shall be on the basis of the condition that the ATE station is properly set up, turned on, and ready for UUT (Unit Under Test) testing. If unique actions are not required for start of testing, enter program number only. Set-up illustrations shall be provided, if required, by the complexity of the buildup, which may be two- or three-dimensional.

  •• Operator Actions. Testing data included in the Test Design and Instructions consist of only adjustment and alignment procedures, instructions for operator intervention at the interface (except removal/replacement), and other messages that cannot be displayed on a single CRT (Cathode Ray Tube) display frame or other display devices, illustrations (i.e., waveforms, sketches, etc.), and references thereto. References to the testing data shall appear on the display panel. Preferably, illustrations referenced will be placed on the same page as the testing data.

    Illustrations of the UUT with all operator actions points should be provided as required and should show the reference designation on or near the components involved. The only components that shall be illustrated are those necessary for positive identification of the operator action points. If there are no operator action points, no illustration should be provided. Any safety points shall be identified with a warning on the illustration. Illustrations shall be provided to show where alignment/adjustment components are located.

•• English-Language Test Description

••• General. This section shall contain a functional flow chart prepared in accordance with the ATE Programming Manual and description of each test. A description of the functional tests shall be included. The purpose of this description shall be intended to (1) summarize the test functions and the test numbers associated with each test function, (2) discuss the test philosophy in sufficient detail to point out the parameters of the UUT that are tested with reference to the functional test number involved, and (3) discuss functional flow diagramming in order to make this section of the flow chart clear to a reader unfamiliar with ATE application test programming.

••• Test Design Criteria. This section shall contain all rules that apply to the TPS contractor in TPS generation. In general, the design criteria shall be contained in the Guidelines for Acquisition, Use, and Configuration Control of TPSs for ATE.

••• Static Tests. This section shall describe all static tests conducted prior to application of power for fault-isolation purposes.

••• Dynamic Tests. This section shall describe all tests conducted to prove that the UUT is operating within its performance specification.

••• UUT Interface Requirements. For each UUT, the contractor shall prepare an ATE UUT interconnection diagram.

-- Necessary interface between the ATE functions through the patch-board to the UUT and through the test accessories shall be provided by the contractor or agency responsible for program validation.

-- Tests requiring accuracies or capabilities not available in the ATE shall be documented. Where active signal conditioning is required in the adapters to provide UUT test capability not available in the ATE, the requirements shall be determined by the contractor's good engineering practices and shall be specified.

-- Layout, fabrication, and static checking of each adapter and special adapter cable shall be accomplished by the contractor. Changes to the interconnection diagram as a result of adapter layout shall be provided by the contractor.

-- A proposed spares list for the ID shall be provided.

•• Supplementary Data. Following is a brief description of all elements of supplementary data:

••• Listing. Provides the complete source listing (including ID data) of the test program and shall consist of a

standard 80/80 listing of the source deck. Since most programs are rather voluminous, it is strongly suggested that the submittal of the program for listing be performed once when all other reports, tables, and flow charts have been coded and debugged.

- ••• Functional Flow Chart (FFC). Provides the end-to-end UUT-oriented philosophy of the UUT on a major function basis. This programmed flow chart is intended to provide the user with an overall ("big picture") test philosophy of the UUT. Its content should generally consist of end-to-end tests, sequenced in the order performed.
- ••• Diagnostic Flow Chart (DFC). Provides the detailed UUT-oriented methods employed on a test-by-test basis showing all branching and including the purpose, methodology, and expected results of each test.
- ••• Interconnection Diagrams. Provides the UUT, ID, and ATE interconnection information test by test. Two types of diagrams are required, a system diagram and test diagram.
- ••• Cross-Reference Table. If digital automatic test generation is employed in the TPS, all inputs and outputs of the digital simulation technique shall be provided, including any design aids used by the TPS contractor.

• Engineering Notes. Any special UUT or information that should be brought to the attention of the operator shall be included in the TPS, for example, telling the operator that some particular action may result and shall be expected. Notice of such items should be limited to those that might cause the operator to unnecessarily terminate testing. Descriptive and theory information on the UUT or test program shall not be included.

• Quality Assurance Provisions

- •• Legibility. The original and all copies of this document shall meet industrial practices for legibility. Standard methods of reproduction may be used provided that legibility is retained for all copies.
- •• Manuscript Preparation. The initial pages of the Test Design and Instruction Documents shall have formats similar to those shown in Figures 1 through 4 of this Addendum. Test pages shall be typewritten and shall be numbered consecutively, using Arabic numerals. Tests in the flow chart may be hand-lettered. Schematic and interconnecting diagram lettering may also be prepared free-hand. For logic symbols, the ANSIX3.5-1970 or equivalent must be used.
- •• Hazard Notice. Hazards associated with the tests, together with appropriate warnings or cautions, shall be included in the Test Design and Instruction Document. If there are no hazards associated with the testing, a statement to that effect shall be inserted in Section 2.8, Engineering Notes.

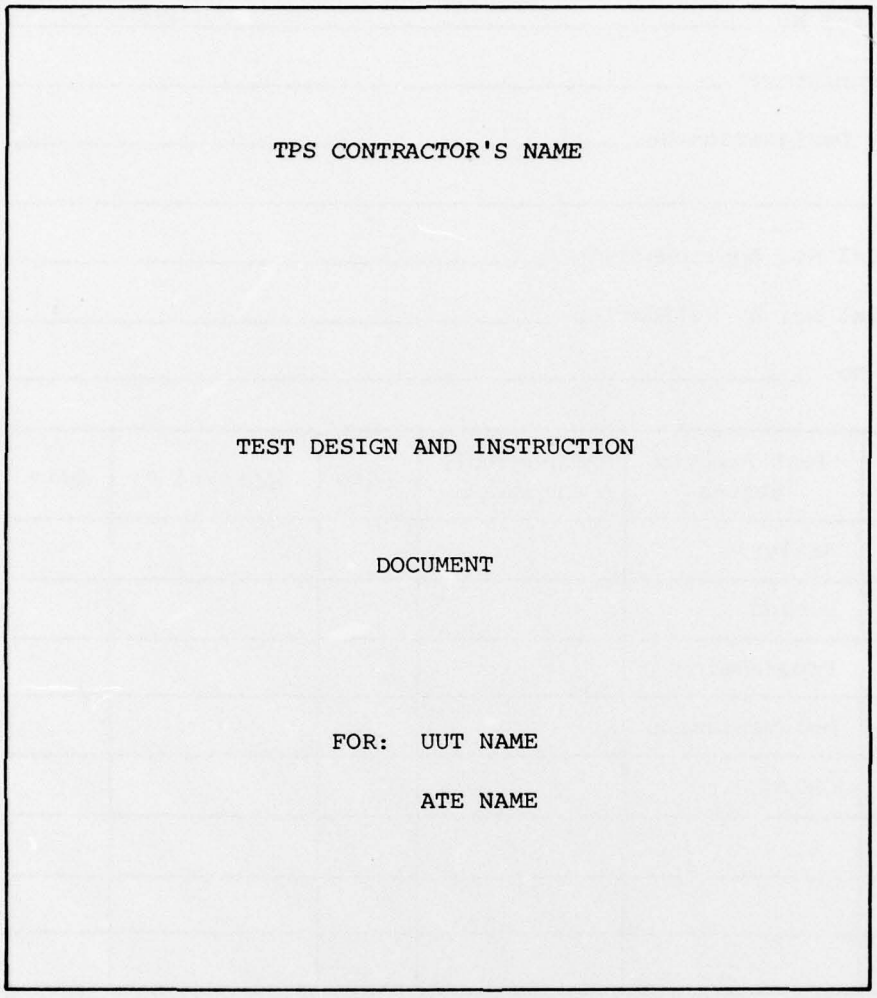

Figure 1. SAMPLE TITLE PAGE

•• Testing Flow Charts. Flow charts for testing, in conjunction with Program Listings, shall depict all program steps. The actual message to appear either as instruction, information, or in a printout shall be included.

UUT Control No. _____

UUT Nomenclature _____

Military Designation No. _____

System _____

UUT Serial No. Applicability _____

UUT Serial No. at Validation _____

Adapter No. _____

Date	Test Program Status	Responsible Engineer	Date	Approved By	Date
	Analysis				
	Design				
	Programming				
	Documentation				
	ORT/CERT				

Figure 2. SAMPLE SUMMARY PAGE

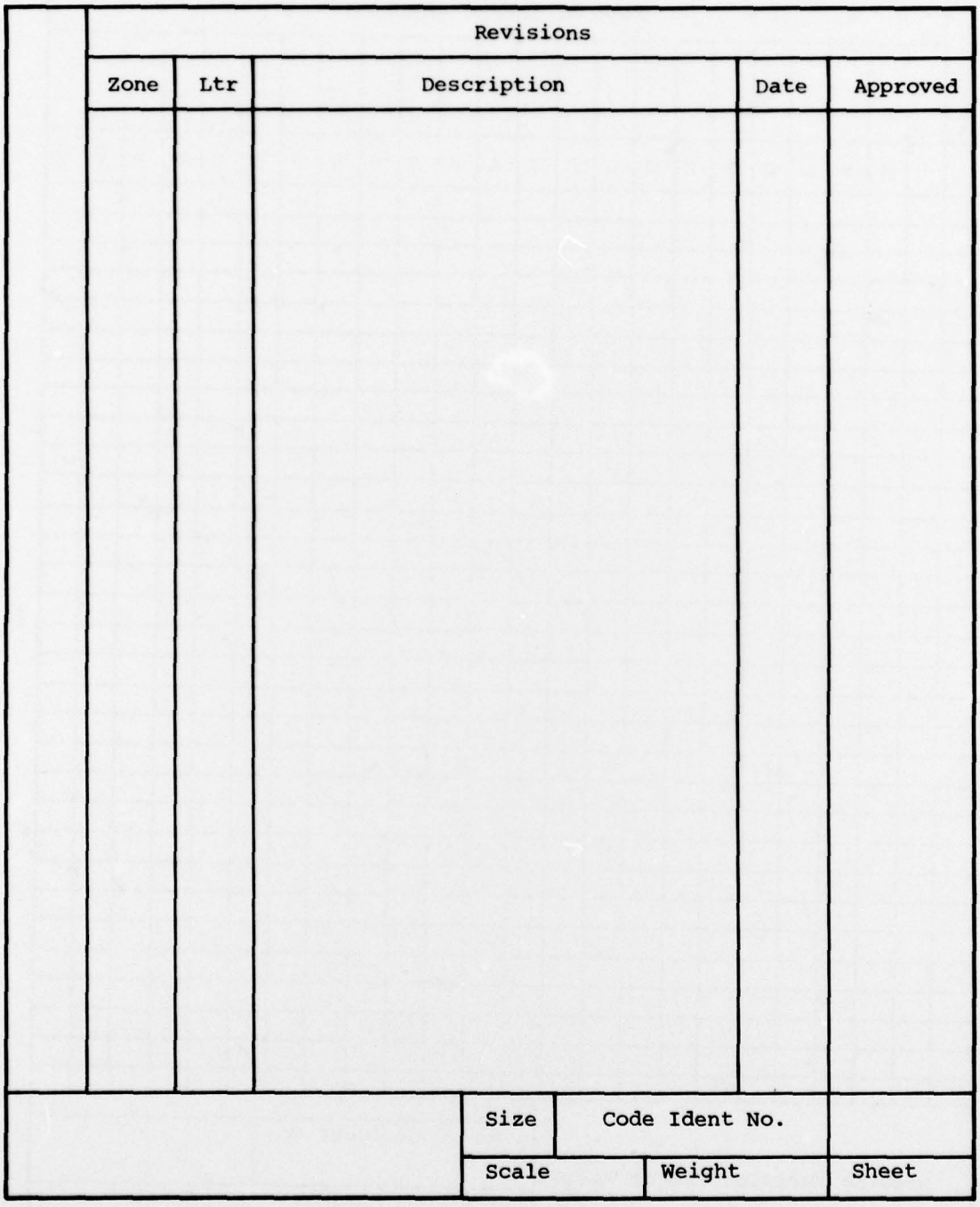

Figure 3. SAMPLE STATUS TABLE

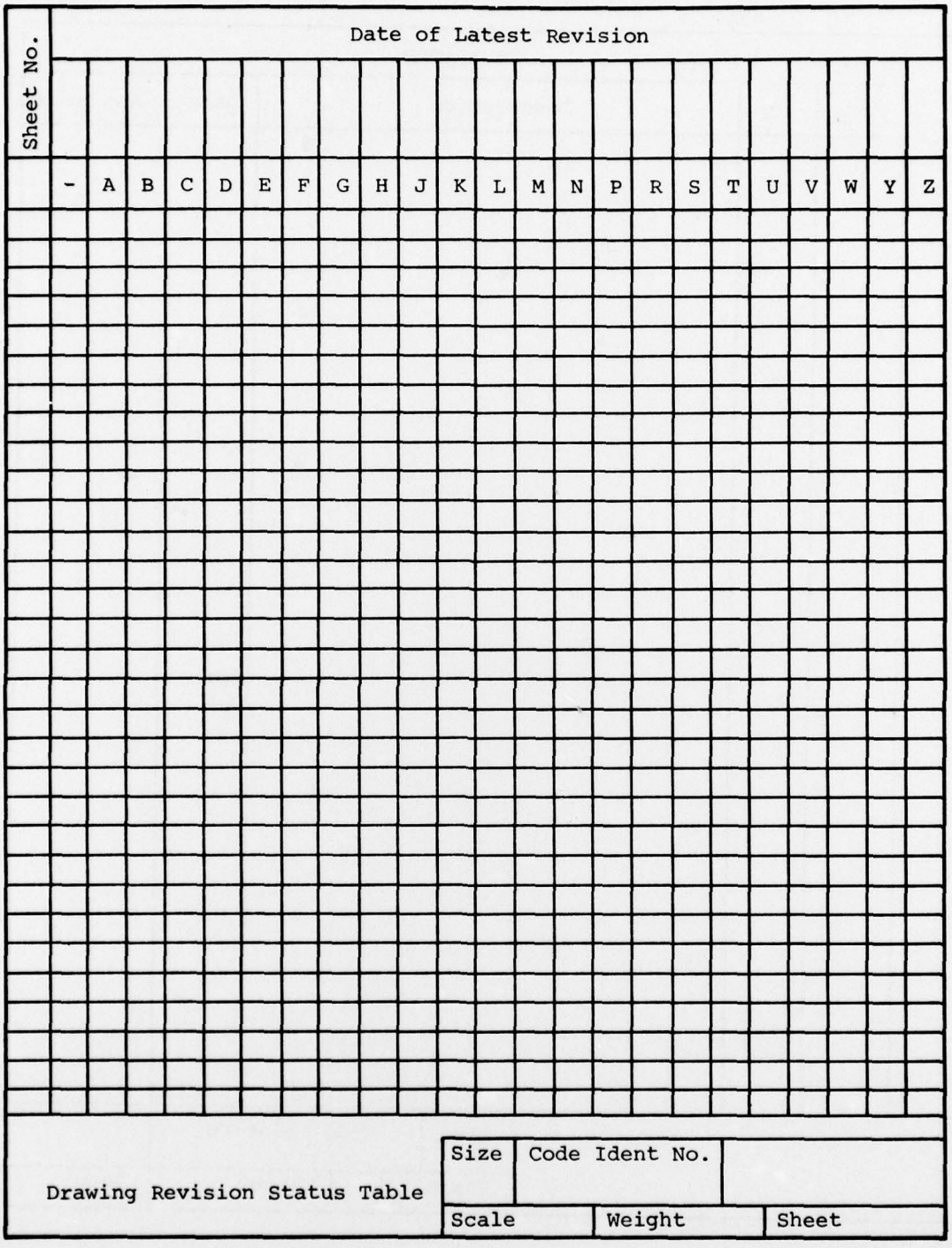

Figure 4. SAMPLE REVISION SHEET

ATTACHMENT 2

DI-E-YY

Block 1. Test Program Set Design Plan

Block 3. This plan is used by the procuring activity to assess the contractor's planning for the TPS computer programs, interface device, and documentation; to approve the contractor's approach for TPS development; and to monitor and evaluate the contractor's effort in TPS development.

Block 7. The DID applies to all TPS development and acquisition contracts. The plan may be obtained during the proposal phase.

Block 10. The TPS Design Plan is a document identifying the contractor efforts required to develop and deliver the TPSs and any necessary TPS maintenance hardware and software in accordance with the terms of the contract. As a minimum, the plan shall include:

- The organizational responsibility and structure of the group that will be designing, producing, and testing all TPSs
- The management and technical control that will be utilized during TPS development
- The methodology for ensuring satisfactory TPS design and testing, including measures necessary to ensure testability, criteria for adequacy, and feasibility of requirements; to establish compliance of the test plans and procedures; to monitor tests and certify test results and test reports; and to ensure maintenance of test documentation
- The approach that will be taken to develop and qualify the elements of the TPS
- The schedule allocated for the development of each TPS, the schedule and procedures for preparation and execution of the concept, detailed design reviews, and the acceptance test
- The approach for monitoring and reporting the progress and status of TPS development
- The level of manpower that will be allocated to each TPS development task beginning with preparation of the initial Test Design and Instruction Document and the ID Development Specification through qualification testing of each TPS

- The contractor's capability or plan for establishing the development of TPS computer programs and the controls that will be implemented to ensure availability of the data processing equipment necessary for verifying the software
- The extent of in-plant testing, including test planning, test methods, documentation, and test reporting
- The general procedures for reporting, monitoring, and resolving TPS program errors and deficiencies during in-plant testing, corrective actions will include analysis of problem and deficiency reports, analysis of trends, and methods of ensuring adequacy of corrective measures taken and their proper implementation.
- The techniques that will be used for controlling the design of the TPS and for ensuring that all performance and design requirements have been implemented within the intent of the system, these techniques will include the controls necessary to ensure that the design of the software follows the requirements of the Test Design and Instruction Document and that the ID design follows the development specification.
- The approach for configuration control of computer program master tapes and associated documentation, including identification of both source and object code in various forms or versions from initial approval or acceptance until incorporated into the final deliverable medium, the configuration management procedures will be audited.
- The identification of special simulation, data reduction, or utility tools that are planned for use in the development of the TPSs that are not deliverable under the terms of the contract. In addition, those tools, techniques, and methodologies used to support the objectives of the program will be identified, and a description of their use to augment or satisfy program requirements will be provided.
- The plan for ensuring TPS growth, modularity, and ease of modification
- The approach for developing TPS documentation, including standards used, provisions for ensuring delivery of correct documentation and change information, and provisions for periodic review by an independent agency and designated approval authority
- The approach for ensuring TPS and ATE compatibility

ATTACHMENT 3

DI-E-ZZ

Block 1. Test Program Set Software Media

Block 3. This plan is used by the procuring activity to define preparation requirements for TPS computer software.

Block 7. These preparation requirements apply to all TPS software developed for the UUT.

Block 10. The TPS software media requirements shall consist of but are not limited to the following:

- Preparation for delivery shall be in accordance with the contract.
- Source programs shall be delivered as specified on DD Form 1493 (e.g., on punched cards, magnetic tape, or other specified medium) using the Government-approved language. The source form shall be suitable for assembly or compilation, as appropriate.
- Object code shall be prepared in machine language and delivered as specified on DD Form 1493 (e.g., on punched cards, magnetic tape, or other specified medium). The object code form shall be suitable for loading and execution in the specified automatic test equipment (ATE).

APPENDIX E

TPS ACQUISITION CHECKLIST

The TPS checklist is provided to facilitate the use of the guidelines provided in this document for the preparation of a technical statement of work (SOW). It lists the type and quantity of data to be specified for the specific TPSs that will be procured. Each data item is cross-referenced with the section number of this document in which detailed descriptions or guidelines are provided.

Section	Required Data
2.1	Define the UUTs and ATEs and their characteristics (language, configuration, version, etc.).
2.3.1	Identify the data items and their sources and status (preliminary, final, etc.) on UUT, ATE, and ATE support software.
2.3.5.2	Inform the contractor of the security classification of the UUT, ATE, and TPS data and the applicable security regulations.
2.3.5.3	State the period of warranty required for the TPS.
2.4.2	State the intended usage environment of the TPS (factory, general support, or direct support).
2.4.2	Specify if ID has to be fully militarized.
2.4.2	Specify if MIL-STD-471 is to be used for ID maintainability demonstration.
2.5	Specify performance and/or diagnostic testing requirements and level of isolation (to an LRU, a card or a number of components, etc.). Specify environmental testing requirements.
2.5.4	Specify environmental conditions under which TPSs must be tested.
2.6.1	Specify the medium to be used for delivery of the TPS source and object code and support software programs.

APPENDIX F

ORGANIZATION OF TPS OPERATIONS

A centralized TPS support engineering organization is recommended, which should consist of a TPS Organic Maintenance Group and a TPS Analysis Group (see Figure F-1).

1. OPERATOR FUNCTION

The primary function of the operator is to test and diagnose the UUTs and to perform limited maintenance on the ATE. The operators' maintenance responsibilities may vary slightly at the factory, depot, general support, and direct support levels. However, the maintenance responsibility of the operators shall be limited to the following:

- Maintenance in accordance with preventive maintenance schedules
- ID maintenance whenever possible; sufficient sets of ID spares shall be included in the Essential Items Stockage List (EISL)
- ATE instrument or module replacement only

Operator diagnostics shall be limited to those functions automatically directed by the ATE. The operator shall be provided with intermediate instructions and/or object code for TPS execution and shall not be permitted to perform software maintenance or program enhancement and development. Figure F-2 presents an overview of ATE operations.

1.2 Production Test Scheduling

On the basis of the complexity and peculiarities of the UUTs being tested, a production test schedule shall be prepared for each test station to minimize set up and tear down, as well as ATE self-test and calibration requirements.

For stations testing many different types of UUTs, a computerized scheduling system to optimize ATE and TPS usage is highly recommended. In addition to scheduling the testing of UUTs, the scheduling schemes will select and sequence the many types of tests and retests, possibly by UUT serial number, other identification, or by criteria derived from previous UUT test history.

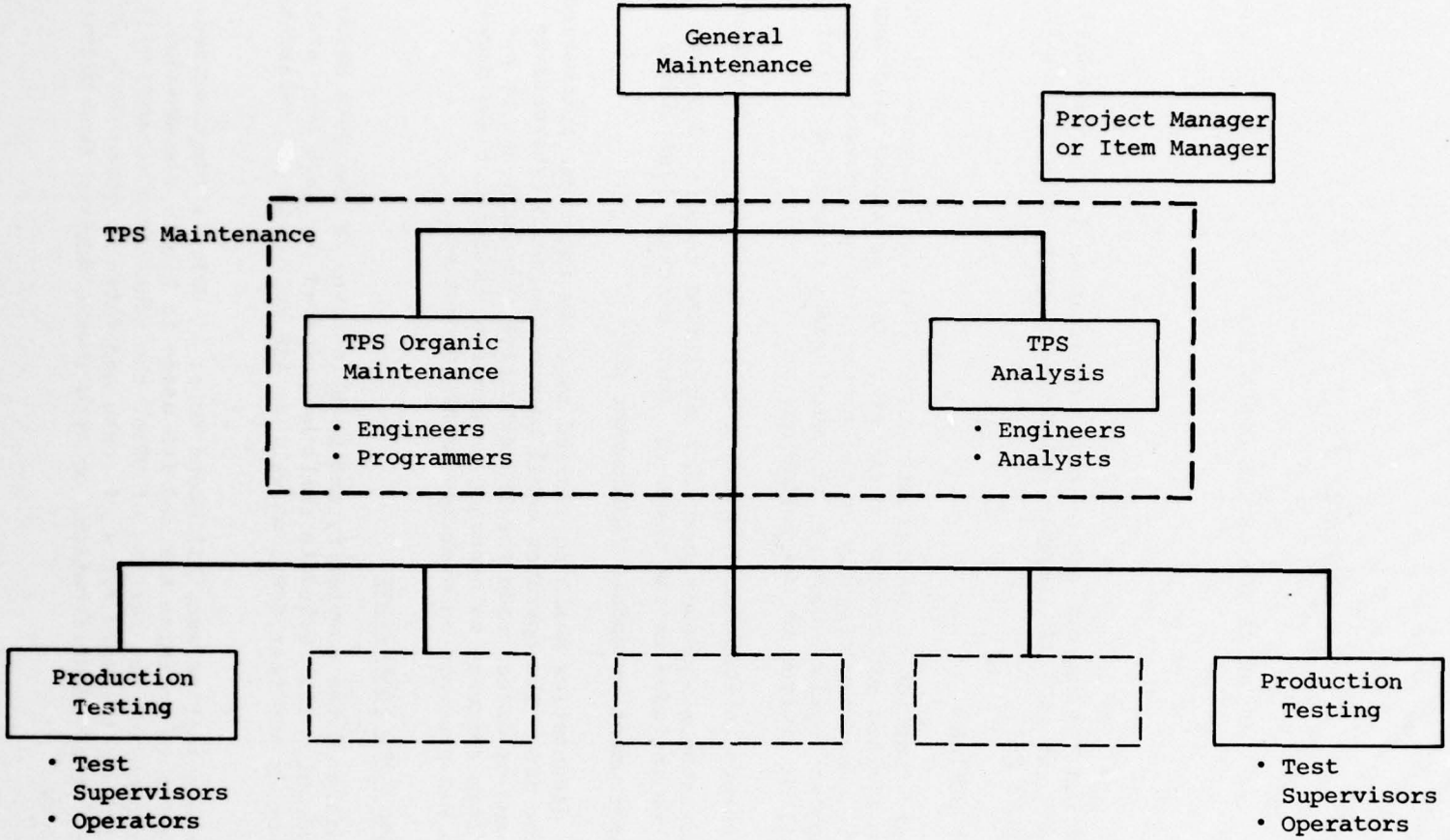

Figure F-1. ORGANIZATION OF TPS SUPPORT ENGINEERING

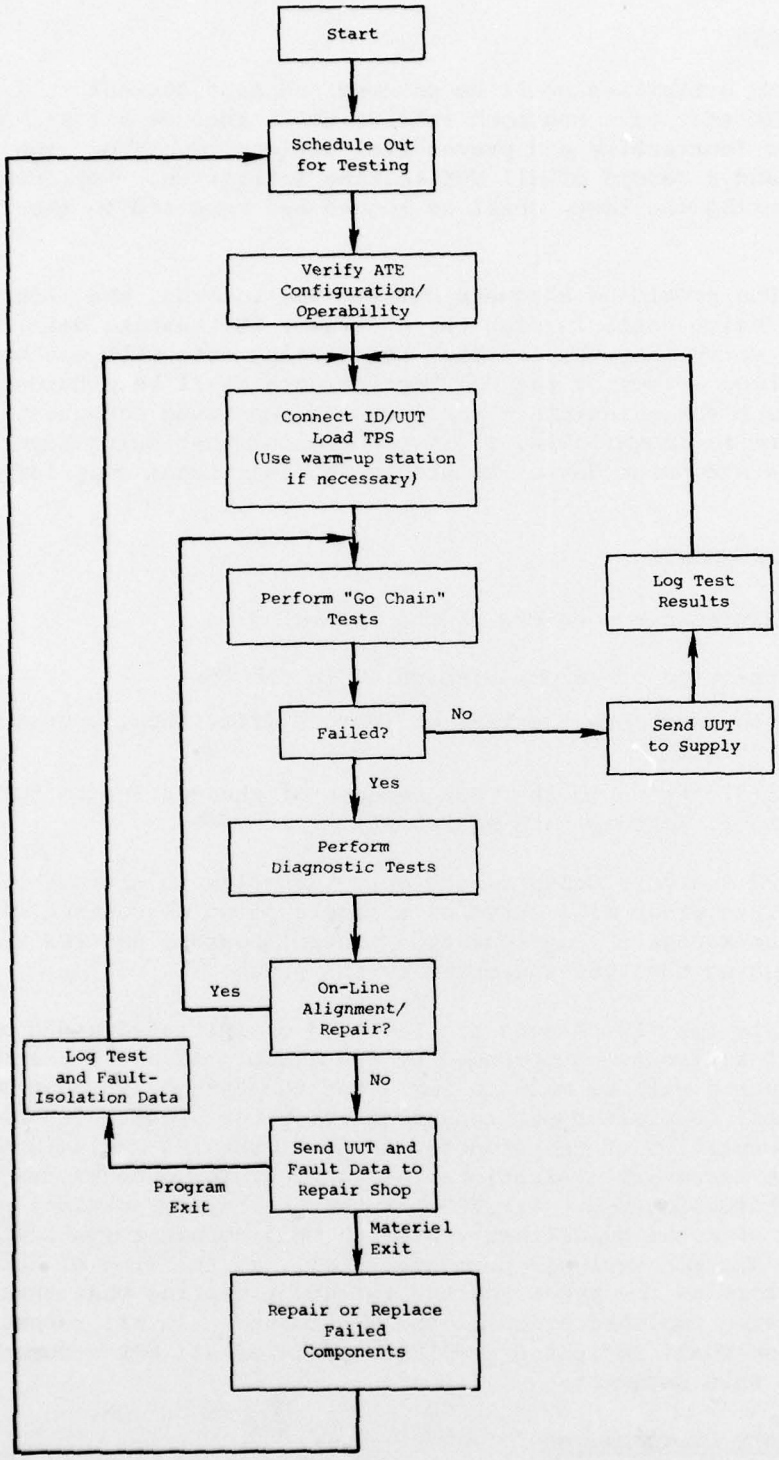

Figure F-2. OVERVIEW OF ATE OPERATIONS

1.2 ATE Logs

All ATE activities shall be entered and kept current in a log book for each ATE station. Log book entries shall include all ATE and ID maintenance (corrective and preventive) actions, operator sign-in and sign-out, and a record of all UUT testing activities. Any anomalies observed during the tests shall be logged and reported to the TPS Analysis Group.

For TPSs providing adequate UUT testing records, the printout from the print device shall furnish the necessary UUT testing data, and an additional entry into the log book for testing data will not be necessary. When possible, a copy of the UUT testing data shall be provided on a magnetic tape for maintenance analyses and reporting purposes. If magnetic tape logging is unavailable, it is recommended that multi-layer papers be used in the ATE print device to provide an additional copy for maintenance purposes.

2. TPS MAINTENANCE

TPS maintenance consists of the following:

- Correction of errors discovered in the TPS
- Enhancements to the TPSs to improve efficiency, operator interface, or utility
- Modifications to the TPSs because of changes in the UUT, ATE, or support software and equipments

The TPS Analysis Group is the only authority to approve TPS maintenance actions. This group will serve as a single point of contact with Army Product/Item Managers, configuration control boards, and TPS users at all locations using the TPSs supported by the group.

Requests for TPS changes are reviewed or initiated and analyzed, and a course of action is recommended by the group. If a TPS change is approved, a determination will be made to implement the changes through warranty applications, contractor maintenance service, or organic TPS maintenance. Upon implementation of the proposed changes, the TPS Analysis Group shall perform the necessary evaluations, assign revision numbers, and release them for production use. All TPS maintenance implementations shall be in accordance with the guidelines stated in this document for new TPS acquisition. The systems analysis personnel shall, at the time of approving a change, determine the types and the extent of testing that shall be necessary following implementation of the TPS change. In all cases, the maintenance action shall include a complete update of all TPS documentation as defined in this document.

2.1 Warranty Coordination

The TPS Analysis Group shall determine if the required changes are covered under the terms of any warranties or maintenance contracts and

take the appropriate actions, either directly or through the procuring agencies to request corrective actions.

2.2 Organic Maintenance

The TPS Organic Maintenance Group provides the Army with the in-house capability of performing TPS maintenance. Depending on personnel availability and the type and extent of TPS maintenance required, organic maintenance is recommended. Small maintenance actions that do not warrant documentation for outside contracting and those changes requiring close coordination between the various Army maintenance organizations shall be performed organically. Organic maintenance capability may be augmented by contractor personnel working under the direction of Army organic maintenance as an extension of Army resources during periods of high demand for maintenance.

2.3 Contractor Maintenance

For extensive changes or rewrites of the TPSs, contractor maintenance is recommended. Acquisition of contractor maintenance services shall be treated in the same manner as procurement of new TPSs, where applicable. Reviews, audits, and validation testing of TPSs that have undergone major rewrites or extensive changes shall be identical to those required for new TPS acquisition.

3. ANALYSIS REQUIREMENTS

The minimal analyses necessary for approval of TPS changes shall consist of the following:

- Effect of the proposed change on operational aspects of other TPSs
- An economic or cost-effectiveness analysis for those changes that are intended to enhance the TPS
- Effect on testing schedules
- An analysis to determine the possibility that changes can be made to the software portion of only the TPS and not to the interface device; ID changes normally require a long lead time
- A reliability and maintainability analysis
- A review of historical data on the types of changes requested